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Original Research

Food and Beverage Environments at Store Checkouts in California: Mostly Unhealthy Products

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A B S T R A C T

Background: As the only place in a store where customers must pass through, checkouts may be especially influential over purchases. Research is needed to understand the healthfulness of checkout environments.
Objectives: The objective of this study was to classify checkout product facings in California food stores.
Methods: In a cross-sectional study, 102 stores, including chains (dollar stores, drugstores, specialty food stores, supermarkets, and mass merchandisers) and independent supermarkets and grocery stores were sampled from 4 northern California cities. Observational assessments of each checkout product facing were conducted in February 2021 using the Store CheckOUt Tool. Facings were classified by category and healthfulness, defined by meeting Berkeley's Healthy Checkout Ordinance's healthy checkout standards: unsweetened beverages and specific foods containing ≤5 g added sugar and ≤200 mg sodium per serving. Log binomial regressions compared healthfulness by store and checkout characteristics.
Results: Of 26,758 food and beverage checkout facings, the most common categories were candy (31%), gum (18%), sugar-sweetened beverages (SSBs; 11%), salty snacks (9%), mints (7%), and sweets (6%). Water represented only 3% and fruits and vegetables 1% of these facings. Only 30% of food and beverage facings met Berkeley's healthy checkout standards, with 70% not meeting the standards. The percentage of food and beverage facings not meeting the standards was even higher (89%) among snack-sized packages (≤2 servings/package). Compared with chain supermarkets, mass merchandisers, and specialty food stores (34%–36%), dollar and independent grocery stores had a lower percentage of food and beverage facings that met the healthy checkout standards (18%–20%; $P < 0.05$). Compared with lane and register areas (35%), endcaps and snaking sections within checkouts had fewer food and beverage facings that met the standards (21%–23%; $P < 0.001$).
Conclusions: *Most foods and beverages at checkout consisted of candy, SSBs, salty snacks, and sweets and failed to meet the healthy checkout standards.*
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Keywords: added sugars, checkout, food environment, food industry, grocery, healthy retail, nutrition policy, sugars, sodium, supermarkets

Introduction

In the United States, children and adults consume excessive amounts of added sugar, sodium, and ultraprocessed foods [1–3], elevating the population's risk of developing type 2 diabetes, heart disease, and other conditions [4–8]. Because stores provide the majority of the foods and beverages consumed in the United States [9–11], the retail food environment is a high-priority setting for improving diet quality. Multiple reviews have found that key aspects of store food environments, such as

Abbreviations: HCO, Healthy Checkout Ordinance; PR, probability ratio; SCOUT, Store CheckOUt Tool; SSB, sugar-sweetened beverage.

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product placement, influence the healthfulness of consumer food and beverage purchases [12–15].

Because the checkout area of a store is the only place all customers must pass through and is known to trigger impulse purchases, checkouts may be particularly influential over consumer choices [16–18]. In fact, in a national sample of United States adults, over one-third reported buying a food or beverage found in the checkout area during their last visit to the grocery store [19]. Because of checkout salience, processed food manufacturers pay large sums of money and offer other incentives to stores to place their products—typically sugary or salty foods and beverages—at checkout [15,18,20–27]. To address these issues, Berkeley, CA, became the world's first jurisdiction to implement a healthy checkout policy. Berkeley's Healthy Checkout Ordinance (HCO) permits only unsweetened beverages, foods in specific categories (gum and mints with no added sugars, fruit, vegetables, nuts, seeds, legumes, yogurt or cheese, and whole grains) that contain ≤5 g of added sugar and ≤200 mg of sodium per serving and nonfood/beverage items at checkout in stores with >2500 sq ft of floor space and ≥25 linear ft of food [28]. This policy has the potential to encourage healthier purchases from stores given evidence that voluntary checkout standards focused on limiting candy and sweets and encouraging products like fruits, nuts, water, and juice [29] have been associated with fewer purchases of sweets and salty snacks [30].

Understanding the current state of checkout environments is key for assessing the need for checkout policies. The literature on United States food store checkouts has documented a high availability of sugar-sweetened beverages (SSBs), candy, and salty snacks at checkout [21–27]. However, almost all of these studies have relied on checklist measures that assess only the dichotomous presence of products at checkout by store or checkout lane instead of assessing each product facing (i.e., each of the individual products that face consumers from which a product can be selected [27]). For example, one study found that 98% of nontraditional food stores had ≥1 unhealthy product near a register [23], and another study of supermarkets found that 53% of checkouts carried ≥1 regular soft drink [21]. Thus, these prior peer-reviewed studies did not distinguish between stores that carried a small proportion compared with a preponderance of unhealthy foods and beverages at checkout (e.g., 1 candy bar compared with 99 candy bars out of 100 product facings at a checkout). This is important because product assortment can influence consumer choices [12,30]. Furthermore, no prior study has examined the healthfulness of checkout environments in northern California, where multiple cities and counties are actively considering healthy checkout policies similar to Berkeley's [31–33]. Thus, the objective of this study was to measure and characterize the distribution of food and beverage facings at checkout and their healthfulness, defined by the Berkeley HCO, in food stores across 4 cities in northern California.

Methods

Design and city sample

This cross-sectional study assessed the checkout environment in a sample of 102 food stores located in 4 California cities: Berkeley, Oakland, Davis, and Sacramento. These cities were sampled as part of a larger evaluation of Berkeley's HCO, and this current study analyzed the baseline data from that ongoing evaluation. Data presented herein were collected in February 2021, prior to the implementation of Berkeley's HCO. Because this study did not involve human subjects data, institutional review board approval was not required.

Stores

We sampled a census of ($n = 24$) Berkeley stores that were *1*) identified by policy proponents as stores that would be subject to the HCO at the time the policy was being developed and *2*) open in February of 2021. Across the city, this included all supermarkets, chain specialty food stores, chain drugstores, and mass merchandisers; 2 of 3 available dollar stores; and all independent grocery stores larger than 2500 sq ft. The city's one convenience store that is large enough to be subject to the policy was not sampled because, at the time, proponents discussed excluding convenience stores.

To sample stores in the comparison cities, a store list was developed using ReferenceUSA [34], chain website directories, and Google Maps. Store types were classified using the North American Industry Classification System, in-store observations of product inventory, and name recognition [35]. Furthermore, independent supermarkets were distinguished from independent grocery stores by their larger square footage and product inventory that was similar in variety to that of a chain supermarket (e.g., produce, frozen, fresh-baked goods, dairy, fresh meats, deli or salad bar, and nonfood products like toiletries and cleaning products). Stratified random sampling was used to match comparison stores to Berkeley stores by chain (if applicable) and store type when possible, to sample a similar number of stores by type from each comparison city. Table 1 shows stores by type and city. Of the 112 comparison stores initially sampled, 4 had no products at checkout, 5 refused data collection, and 1 was perceived as unsafe, resulting in a sample of 102 stores.

Measures

Trained data collectors used the Store CheckOUt Tool (SCOUT) to conduct observational assessments of food and beverage environments at checkouts [36]. Data collectors took contextual (i.e., wide-angled) and detailed (i.e., close-view) photos of every product facing located in sampled checkout areas to record characteristics of each facing (e.g., brand, flavor, and size). The SCOUT has exhibited high interrater reliability (mean $\kappa = 0.95$ and mean intraclass correlation coefficient >0.99) [36]. Each product facing was specific to a product (e.g., a specific brand, flavor, and size of a candy bar) and was defined as the product that faces the consumer but did not include any products stacked behind the facing [27]. Each facing was assessed separately, including when there were multiple facings for identical products (e.g., 2 side-by-side facings for the same brand, flavor, and size of a candy bar would be considered 2 separate facings). Data collectors recorded information on every product facing at up to 3 checkouts per store. If a store had ≤3 checkouts, all checkouts were assessed. If a store had >3 checkouts, 3 checkouts were randomly sampled and assessed. If a store had ≥1 self-checkout, 1 self-checkout was sampled.

Checkouts were defined based on the Berkeley HCO as any area that is accessible to a customer *1*) within a 3-ft distance of any register, or *2*) designated or used primarily to wait in line to make a purchase at a register, up to and including the checkout

TABLE 1
Type and location of stores sampled for observational assessment of checkouts

Store type	Berkeley, *n*	Davis, *n*	Oakland, *n*	Sacramento, *n*	All cities, *n* (%)
Chain drugstore	8	3	10	12	33 (32%)
Chain supermarket	3	6	4	3	16 (16%)
Independent grocery store	4	2	4	4	14 (14%)
Chain specialty food store	3	1	3	4	11 (11%)
Independent supermarket	2	2	3	3	10 (10%)
Chain dollar store	2	2	3	3	10 (10%)
Chain mass merchandiser	2	1	1	4	8 (8%)
Total	**24**	**17**	**28**	**33**	**102 (100%)**

Note: Stratified random sampling was used to match stores in Davis, Oakland, and Sacramento to stores in Berkeley by chain (if applicable) and store type when possible. For some cities, there was an insufficient number of stores by type to match the number in Berkeley. When this occurred, we sampled additional stores of that type from other comparison cities, and within the city with insufficient numbers of a store type, we sampled additional stores of other types.

endcap [28]. We operationalized this definition for a traditional checkout lane as including all products in the checkout lane and register area, the checkout endcaps, and any standalone displays within 1 ft of the endcaps or lane. For snaking sections of checkouts, common in drugstores, assessments included the entire snaking section and any attached endcaps. Snaking sections were considered distinct from the register area of checkout. In stores where there were multiple registers side-by-side with indistinguishable boundaries between them, the whole section of registers was counted as a single lane and register area.

Product facings were classified by their location within checkout: lane and register area, endcap of checkout lane, standalone display within 1 ft of the checkout area, and snaking section (including snaking endcap). Facings were also classified by the staffing of checkout (i.e., self- compared with staffed checkout). The sample excluded any product facings inaccessible to customers due to being located behind the cashier.

Nutritional composition of products, including ingredients, added and total sugars per serving, and sodium per serving, was retrieved and merged with each product facing. Nutrient information was collected for each distinct product (i.e., brand, flavor, and size) observed across facings from the following sources, in order of availability: manufacturer's website, food retailer websites, and publicly accessible databases like the United States Department of Agriculture National Database/Food Data Central and Open Food Facts.

Product facings were classified by category and healthfulness. Categories included nonfood or beverage products, foods and beverages that are top contributors to added sugars or sodium in the United States diet (SSBs, candy [including chocolate], sweets [baked goods and other sweets like frozen desserts, fruit snacks, pudding, candy-coated pretzels/fruit], and salty snacks [e.g., chips, crackers, popcorn, pretzels, dried meats]), and other food and beverage categories (fruits and vegetables [fresh, canned, dried, and frozen], nuts and seeds, legumes, water [unsweetened still, sparkling, and flavored], and milk [dairy and nondairy], 100% juice, diet beverages, cheese, yogurt, trail mix, bars [granola, protein, and nut- or seed-based], mints, and gum). In rare instances, a food item was packaged together with a nonfood item (e.g., a chocolate egg containing a toy) but sold as a single product, in which case the product facing was classified as a food and beverage facing.

Healthfulness was determined by the product meeting the healthy checkout standards defined in Berkeley's HCO because its standards are consistent with the *Dietary Guidelines for Americans*' recommendations to consume energy dense foods and limit added sugar and sodium consumption [1], and it is being used as a model policy for other jurisdictions [31–33]. Beverages meeting healthy checkout standards include those with no added sugars and no artificial sweeteners; artificial sweeteners were inclusive of all nonnutritive sweeteners. Foods meeting healthy checkout standards included those with $\leq$5 g of added sugars and $\leq$200 mg of sodium per labeled serving in the following categories: chewing gum and mints with no added sugars, fruit, vegetables, nuts, seeds, legumes, yogurt or cheese, and whole grains [28]. Seeds additionally included any product whose first ingredient was cacao, including some dark chocolates. Products within the permissible added-sugar and sodium limits were further classified by their first ingredient (e.g., fruit).

Analytic sample

A total of 41,564 checkout facings were captured with the SCOUT. Of these, 1527 (4%) facings were not available for coding (e.g., out of stock or had obscured labels due to product rotation or poor photo quality), and for another 651 (2%) facings, an insufficient amount of nutritional information could be retrieved to classify products (e.g., an imported or discontinued product with no manufacturer website). Thus, the analytic sample included 39,386 checkout facings.

Analysis

Frequencies (counts and percentages) were calculated to describe facings by location within checkout (e.g., endcap), product category (e.g., SSBs), consistency with healthy checkout standards, store type, and staffing of checkout. The percentage of food and beverage facings meeting the standards was also calculated separately after *1*) restricting the sample to facings for smaller, snack-sized packages (i.e., excluding facings for products containing >2 servings per package) and *2*) excluding gum, as this product is not ingested.

To compare the probability that food and beverage facings met the healthy checkout standards between locations at checkout, store types, and staffing of checkout, we used log binomial regressions to calculate probability ratios (i.e., relative risks). All regressions were clustered on location of the product facing and defined by store and location within checkout. In regression models, the reference group for checkout location was the lane and register area, and the reference group for store type was chain supermarket. Postregression *t* tests were used to

examine all other pairwise comparisons within location and store type. Adjusted models included indicators for location within checkout and store type but not an indicator for self-checkout because self-checkout was not associated with meeting healthy checkout standards in the unadjusted model. All analyses used a 2-sided $\alpha = 0.05$ and were conducted in Stata/MP15.1 (StataCorp).

Results

Of the 39,386 checkout facings, 12,628 (32%) were nonfood/beverage facings, and 26,758 (68%) were food and beverage facings. Of food and beverage facings, 20% were beverages, and 80% were food (Table 2). The most frequent location of checkout food and beverage facings in the overall sample was the lane and register area ($n = 15,689$, 59%), followed by checkout endcaps ($n = 5386$, 20%), snaking section of checkout ($n = 4504$, 17%), and standalone displays ($n = 1179$, 4%; Supplementary Table 1).

Of food and beverage facings, the 7 most frequent categories were candy (31%), gum (18%), SSBs (11%), salty snacks (9%), mints (7%), sweets (6%), and diet beverages (5%; Figure 1). In contrast, healthier items were far less frequent, including water (3% of food and beverage facings), nuts and seeds (2%), fruits and vegetables (1%), legumes (0.1%), and milk (0.02%). Table 2 shows frequency of additional facing categories by location within checkout.

Across beverage facings, the majority were classified as SSBs (53%); soda was the most frequent SSB (40%), followed by energy drinks (31%) and sweetened coffees and teas (16%). The second most frequent category across all beverage facings was diet beverages (24%), followed by water (16%; Table 2).

The distribution of product facings varied by location (Figure 1). For example, candy was the most frequently available food and beverage category observed in the lane and register area (39%) and snaking area (25%) of checkout. SSBs were the most frequently available food and beverage category in checkout endcaps (26%), and salty snacks were the most frequently available food and beverage category in standalone displays (23%).

Table 3 shows the frequency of food and beverage facings by location and whether they met the healthy checkout standards defined by the Berkeley HCO. Across all checkout locations, only 30% of food and beverage facings met the healthy checkout standards, with the most frequent category being gum with no added sugars (54%), followed by mints with no added sugars (15%), unsweetened beverages (15%), nuts (7%), fruit (3%), seeds (2%), and whole grains (2%), whereas vegetables, legumes, and yogurt or cheese each comprised <1% of these facings. Among the food and beverage facings that did not meet the healthy checkout standards (70%), candy was the most frequent of these facings (44%), followed by SSBs (15%), salty snacks (13%), sweets (8%), and diet beverages (7%), with the remaining categories each comprising <4% of food and beverage facings that did not meet the standards. When restricting to snack-sized packages that contained ≤2 servings per package ($n = 12,848$), an even higher percentage of food and beverage facings did not meet the healthy checkout standards (89%). When excluding gum from facings ($n = 21,829$), the percentage of food and beverage facings not meeting the standards was also higher (83%).

Table 4 shows the distribution of facings (all, food and beverage, and food and beverage that met the healthy checkout standards) and unadjusted and adjusted probability ratios for meeting standards between locations at checkout, store types, and self- compared with staffed checkouts. The majority of facings in all locations within checkout and in both self- and staffed checkouts were for food and beverage products (range: 61% in snaking to 70% in lane and register areas and endcaps and 67% in staffed to 82% in self-checkouts). Independent grocery stores had the highest percentage of food or beverage checkout facings (78%), whereas chain dollar stores had the lowest percentage (48%).

In unadjusted and adjusted models (Table 4), food and beverage facings in snaking areas and endcaps were significantly less likely to meet the healthy checkout standards than facings observed in the lane and register areas (P values < 0.001). There were no other significant differences between locations within checkout.

Although still low, the percentage of food and beverage facings that met the healthy checkout standards was highest in chain specialty food stores, chain supermarkets, and chain mass merchandisers (36%, 35%, and 34%, respectively) and lowest in chain dollar stores and independent grocery stores (18% and 20%, respectively; Table 4). The relative differences between these groups of stores were significant (unadjusted and adjusted P values < 0.05). Independent supermarkets and chain drugstores were in the middle (25% and 29%, respectively), with chain drugstores having a significantly lower probability of meeting the healthy checkout standards than chain supermarkets in the adjusted model ($P = 0.015$). Other differences by store type are shown in Table 4.

There was no significant difference in the probability of food and beverage facings meeting the healthy checkout standards between self-checkouts and staffed checkouts ($P = 0.945$).

Discussion

Observational assessments were conducted at checkouts in 102 food stores across 4 cities in northern California in 2021, prior to the implementation of the nation's first healthy checkout policy in Berkeley, CA. A majority of food and beverage facings at checkout represented products generally high in added sugars or sodium: candy (31%), SSBs (11%), salty snacks (9%), and sweets (6%). Other frequently observed categories of food and beverage facings included gum (18%), mints (7%), and diet beverages (5%). Healthier product facings such as water represented only 3% and fruits and vegetables only 1% of food and beverage facings at checkout. Meeting the healthy checkout standards in the Berkeley HCO was used as an overall indicator that a food or beverage was healthy. The majority of food and beverage facings (70%) failed to meet these healthy checkout standards, and this percentage was even higher (89%) when smaller snack-sized packages were considered, which consumers may be more likely to purchase and consume on impulse [37]. Food and beverage facings were less likely to meet the healthy checkout standards in chain dollar stores and independent grocery stores compared with other store types, and when located in the snaking section and endcaps of checkout compared with the lane and register area. These results indicate the importance of ensuring that healthy

TABLE 2
Frequency of food and beverage facings by location and product category

Product category	All of checkout			Lane and register		Endcap		Snaking		Standalone	
	n	%	%B or %F	*n*	%	*n*	%	*n*	%	*n*	%
Food and beverage	26,758	100.0%	n/a	15,689	100.0%	5386	100.0%	4504	100.0%	1179	100.0%
Beverage (B)	5341	20.0%	100.0%	1061	6.8%	2615	48.6%	1334	29.6%	331	28.1%
SSBs	2816	10.5%	52.7%	578	3.7%	1407	26.1%	697	15.5%	134	11.4%
Soda	1139	4.3%	21.3%	238	1.5%	670	12.4%	193	4.3%	38	3.2%
Energy drinks	870	3.3%	16.3%	218	1.4%	354	6.6%	234	5.2%	64	5.4%
Sweet coffees/teas	456	1.7%	8.5%	73	0.5%	196	3.6%	161	3.6%	26	2.2%
Sports drinks	178	0.7%	3.3%	32	0.2%	82	1.5%	64	1.4%	0	0.0%
Fruit-flavored drinks	56	0.2%	1.0%	14	0.1%	29	0.5%	13	0.3%	0	0.0%
Other SSBs[1]	117	0.4%	2.2%	3	<0.1%	76	1.4%	32	0.7%	6	0.5%
Non-SSBs	2525	9.4%	47.3%	483	3.1%	1208	22.4%	637	14.1%	197	16.7%
Diet beverages[2]	1301	4.9%	24.4%	276	1.8%	598	11.1%	373	8.3%	54	4.6%
Water	863	3.2%	16.2%	196	1.2%	404	7.5%	180	4.0%	83	7.0%
Plain still water	598	2.2%	11.2%	154	1.0%	284	5.3%	94	2.1%	66	5.6%
Sparkling water	250	0.9%	4.7%	42	0.3%	105	1.9%	86	1.9%	17	1.4%
Flavored still water	15	0.1%	0.3%	0	0.0%	15	0.3%	0	0.0%	0	0.0%
100% Juice	67	0.3%	1.3%	3	<0.1%	38	0.7%	5	0.1%	21	1.8%
Coffees/teas	78	0.3%	1.5%	2	<0.1%	48	0.9%	24	0.5%	4	0.3%
Milk[3]	6	<0.1%	0.1%	0	0.0%	6	0.1%	0	0.0%	0	0.0%
Other non-SSBs[3]	210	0.8%	3.9%	6	<0.1%	114	2.1%	55	1.2%	35	3.0%
Food (F)	21,417	80.0%	100.0%	14,628	93.2%	2771	51.4%	3170	70.4%	848	71.9%
Candy (including chocolate)	8400	31.4%	39.2%	6110	38.9%	938	17.4%	1114	24.7%	238	20.2%
Gum	4929	18.4%	23.0%	4162	26.5%	281	5.2%	438	9.7%	48	4.1%
Mints	1860	7.0%	8.7%	1581	10.1%	114	2.1%	155	3.4%	10	0.8%
Salty snacks	2488	9.3%	11.6%	997	6.4%	480	8.9%	741	16.5%	270	22.9%
Chips and other snacks[4]	1927	7.2%	9.0%	708	4.5%	344	6.4%	622	13.8%	253	21.5%
Dried meat/jerky	561	2.1%	2.6%	289	1.8%	136	2.5%	119	2.6%	17	1.4%
Sweets[5]	1597	6.0%	7.5%	736	4.7%	466	8.7%	258	5.7%	137	11.6%
Bars[6]	808	3.0%	3.8%	439	2.8%	196	3.6%	156	3.5%	17	1.4%
Nuts and seeds	599	2.2%	2.8%	267	1.7%	143	2.7%	169	3.8%	20	1.7%
Fruits and vegetables	256	1.0%	1.2%	147	0.9%	39	0.7%	33	0.7%	37	3.1%
Fruits	189	0.7%	0.9%	114	0.7%	35	0.6%	29	0.6%	11	0.9%
Fresh fruits	49	0.2%	0.2%	39	0.2%	7	0.1%	0	0.0%	3	0.3%
Other fruits[7]	140	0.5%	0.7%	75	0.5%	28	0.5%	29	0.6%	8	0.7%
Vegetables	67	0.3%	0.3%	33	0.2%	4	0.1%	4	0.1%	26	2.2%
Fresh vegetables	29	0.1%	0.1%	9	0.1%	0	0.0%	0	0.0%	20	1.7%
Other vegetables[7]	38	0.1%	0.2%	24	0.2%	4	0.1%	4	0.1%	6	0.5%
Trail mix	166	0.6%	0.8%	75	0.5%	15	0.3%	63	1.4%	13	1.1%
Legumes[8]	14	0.1%	0.1%	9	0.1%	1	<0.1%	4	0.1%	0	0.0%
Other foods[9]	300	1.1%	1.4%	105	0.7%	98	1.8%	39	0.9%	58	4.9%

Note: Indented subcategories sum to the total of their nonindented parent categories. Standalone displays are those within 1 ft of the checkout area. Snaking includes the snaking portion of and any endcaps of the snaking section of checkouts.
Abbreviations: B, beverage; F, food; SSB, sugar-sweetened beverage.
[1] Sweetened coconut water, sweetened flavored water, powdered SSBs, sweetened milk, kombucha and other probiotic or vinegar drinks, and cannabidiol (CBD) drinks.
[2] The following beverages sweetened with nonnutritive sweeteners: soda; energy, sports, fruit-flavored, powdered, and protein drinks; coffee/tea; kombucha and other probiotic or vinegar drinks; sweetened flavored water; and sparkling sweetened water.
[3] The following unsweetened beverages: coffee beans/grounds and tea bags, sparkling apple cider, coconut water, juice with water, energy drinks, powdered drinks, CBD drinks, kombucha and other probiotic or vinegar drinks.
[4] Potato and tortilla chips, crackers, popcorn, pretzels, corn nuts, cracker and cheese dips, and snack mixes.
[5] Baked goods, desserts, and sweets like cakes, brownies, donuts, cookies, pastries, frozen dessert, sweet snack packs, pudding, syrups and other pourable toppings, sprinkles, and candy-covered pretzels and dried fruit.
[6] Granola, nut, seed, and protein bars and clusters.
[7] Dried (including chips), canned, cupped, or jarred.
[8] Bean snacks and other legumes (dried or canned).
[9] Bread, cheese, cold cereal, sauces and dips, raw or cooked meat, cold prepared food, instant noodles, vegetarian jerky, cooking oil, croutons, dried fish, other seafood, pasta/noodles, granola, and condiments.

checkout policies apply to a broad array of store types and that these policies define the checkout as including the snaking section and checkout endcaps. To our knowledge, this is the first peer-reviewed study of United States food stores to characterize the proportion of food and beverage facings at checkout by healthfulness based on nutritional content. Furthermore, this study provides novel data on the healthfulness of foods and beverages at checkout in California, the

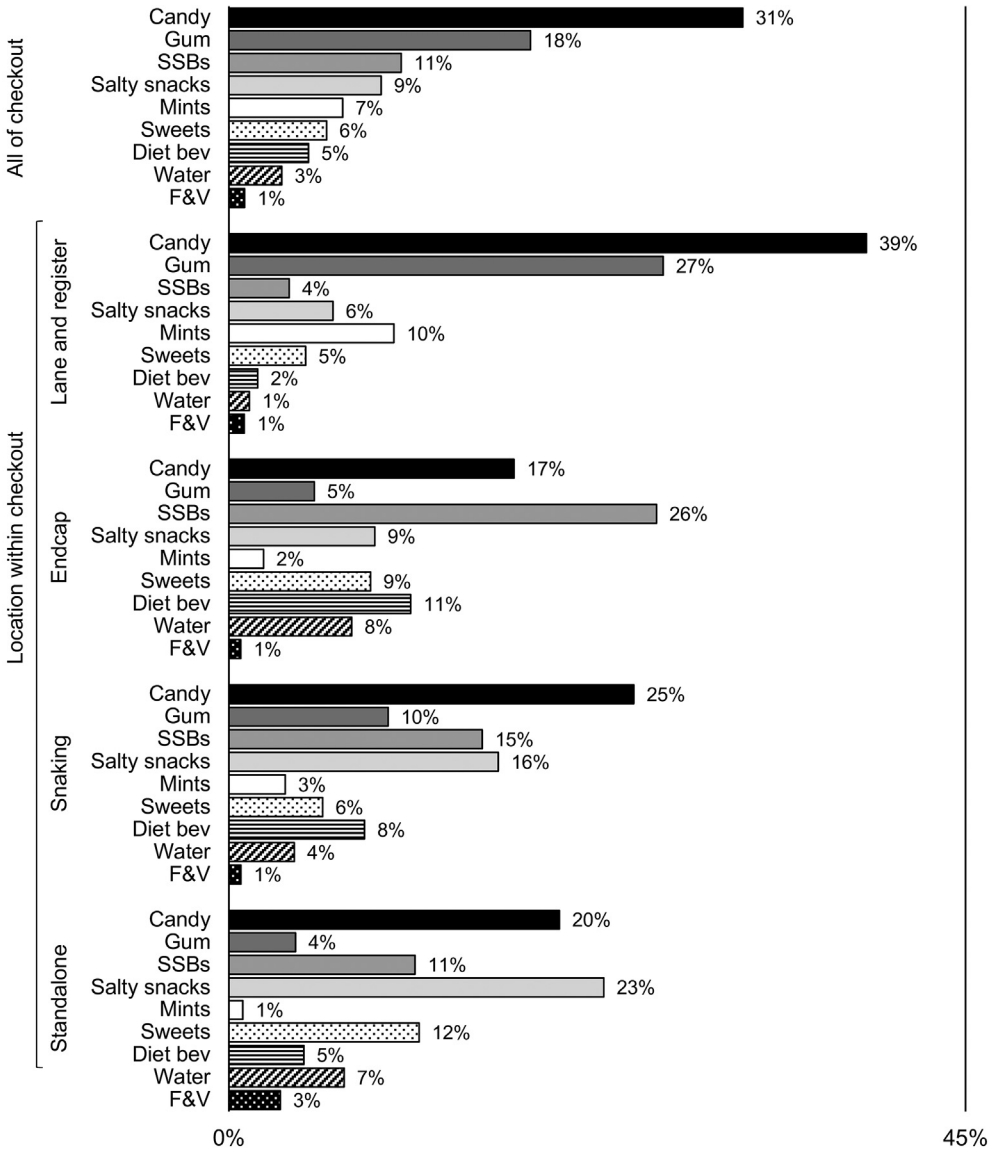

FIGURE 1. Percentage of checkout facings by location within checkout and product category (the 7 most common categories as well as water and fruits and vegetables). Note: Water included all unsweetened still, sparkling, and flavored waters. Sweets included baked goods and other sweets. Diet beverages included all beverages containing nonnutritive sweeteners. F&V included fresh, dried, and canned fruits and vegetables. Standalone displays are those within 1 ft of the checkout area. Snaking includes the snaking portion of and any endcaps of the snaking section of checkouts. Abbreviations: Bev, beverage; F&V, fruits and vegetables; SSB, sugar-sweetened beverage.

nation's most populous state, where multiple healthy checkout policies are under consideration.

Similar to our findings, prior studies of United States checkouts have observed a high availability of ultraprocessed foods and beverages. However, direct comparison was generally not possible because the majority of prior studies did not collect shelf-facing data and instead classified entire checkouts or stores based on the dichotomous availability of $\geq$1 product type. However, a study of 32 supermarkets in several east coast cities observed that 76% of checkout displays carried chocolate, 53% regular soft drinks, 49% confectionaries, and 28% chips [21]; a study of 40 food stores in Pittsburgh, PA, found that 47% to 100% of cash register displays contained sweet or salty foods at checkout [22]; and a study of 119 small food stores in Minneapolis-St. Paul, MN, found that 98% had unhealthy product categories near the register [23]. These prior results are consistent with our findings that candy, SSBs, salty snacks, and sweets were 4 of the top 6 most prevalent categories of food and beverage facings at checkout. The study of Pittsburgh stores also found that dollars stores had more register displays for sweet and salty snacks than did most other store types [22], similar to our finding that dollar stores had the lowest percentage of healthy food and beverage checkout facings. A multicity study assessing only beverages in 52 grocery stores in AL, MS, and southern CA found that about two-thirds of register displays carried SSBs [25], consistent with our finding of high SSB checkout availability. Other studies of United States checkouts were published in reports, including a study using a national sample of food

TABLE 3
Frequency of food and beverage facings that met and did not meet healthy checkout standards defined by Berkeley's Healthy Checkout Ordinance

Product category	All of checkout (n = 26,758)		
	n	%	%H or %N
Met healthy standards (H)[1]	7942	29.7%	100.0%
Beverage (unsweetened)	1224	4.6%	15.4%
Food	6718	25.1%	84.6%
Gum, no added sugar	4271	16.0%	53.8%
Mints, no added sugar	1226	4.6%	15.4%
Nuts	579	2.2%	7.3%
Fruit[2]	257	1.0%	3.2%
All seeds (including cacao)[3]	156	0.6%	2.0%
Whole grains	151	0.6%	1.9%
Vegetables[2]	43	0.2%	0.5%
Legumes	28	0.1%	0.4%
Yogurt or cheese[4]	7	<0.1%	0.1%
Did not meet healthy standards (N)	18,816	70.3%	100.0%
Beverage (sweetened)	4117	15.4%	21.9%
SSBs	2816	10.5%	15.0%
Diet beverages	1301	4.9%	6.9%
Food	14,699	54.9%	78.1%
Candy (including chocolate)	8262	30.9%	43.9%
Salty snacks[5]	2369	8.9%	12.6%
Sweets	1567	5.9%	8.3%
Gum	658	2.5%	3.5%
Mints	634	2.4%	3.4%
Bars[6]	572	2.1%	3.0%
Other[7]	637	2.4%	3.4%

Abbreviations: H, healthy checkout standards were met; N, healthy checkout standards were not met; SSB, sugar-sweetened beverage.

[1] Defined as beverages with no added sugars and no artificial sweeteners (i.e., no nonnutritive sweeteners) and foods with ≤5 g of added sugars and ≤200 mg of sodium per labeled serving in the following categories, determined by product's first ingredient: chewing gum and mints with no added sugars, fruit, vegetables, nuts, seeds, legumes, yogurt or cheese, and whole grains.

[2] Fresh, dried (including chips), canned, cupped, or jarred.

[3] All seeds including products with the first ingredient being cacao or dark, unsweetened, or bittersweet chocolate.

[4] Only cheese because no yogurts were observed at checkout.

[5] Dried meats, potato and tortilla chips, crackers, popcorn, pretzels, corn nuts, cracker and cheese dips, and snack mixes.

[6] Granola, nut, seed, and protein bars and clusters.

[7] Nuts and seeds, trail mix, dried fruit, cheese, vegetables (dried, chips, pickled), bread, cold cereal, sauces and dips, raw or cooked meat, cold prepared food, instant noodles, vegetarian jerky, cooking oil, croutons, dried fish, other seafood, pasta/noodles, granola, condiments, and bean snacks.

stores in school enrollment areas [26] and a study of 30 food and nonfood stores around Washington, DC [27]. The national study found that 88% of stores carried candy and 34% SSBs at checkout, whereas only 13% carried fresh fruits/vegetables and 24% bottled water at checkout [26]. Our study found that, when assessing the proportion of available products rather than just the presence of a product, only 3% and 1% of food and beverage checkout facings were for water and fruits and vegetables, respectively. The report of Washington, DC stores was the only study other than ours to assess product facings and observed similar findings by category: SSBs were the most frequent beverage (60%), and candy (40%), gum (23%), chips and dried meat (9%), and cookies (7%) were among the most frequent foods at checkout [27]. That study also concluded that across checkouts, 90% of food facings were unhealthy (as defined only by category) [27]. Lastly, although we did not assess convenience stores, prior research in the Minneapolis-St. Paul area found that 100% of convenience stores offered candy, candy/-gum machines, chips, or soda at checkout [24].

Multiple studies of United States checkouts in primarily nonfood businesses (e.g., pharmacies, hardware, hotel, apparel, electronics, child-focused merchandise) have also found a high availability of unhealthy foods or beverages at checkout [38–41]. The similarly high availability of unhealthy foods at checkout in these store types suggests that for a healthy checkout policy to comprehensively change checkout food environments, it should also apply to businesses that do not primarily sell food.

The high availability of unhealthy foods and beverages at checkout is not exclusive to the United States. Research on stores in other countries (mostly of supermarkets), has documented a high availability of unhealthy foods and beverages at checkouts in Australia [21,42–46], Canada [21], Denmark [21], New Zealand [21], Sweden [21], and the United Kingdom [21,29,47–49]. For example, similar to our observation that 70% of food and beverage facings did not meet healthy checkout standards, Schultz et al. [46] found that 64% of shelf space at checkouts in Australian supermarkets was dedicated to discretionary foods (e.g., candy, salty snacks, and sweetened beverages).

The high availability of unhealthy foods and beverages at checkout in the present study and previous studies is concerning given that 36% of United States adults have reported purchasing a food or beverage found at checkout during their last grocery shopping trip [19]. This proportion was even higher among parents and low-income and racially and ethnically minoritized adults [19].

This study's finding that dollar stores and small grocery stores had the lowest proportion of healthy food and beverage facings (18% and 20%, respectively) is consistent with prior findings that these types of stores generally have less healthy food environments than supermarkets and other large food stores [50–53]. In contrast, chain specialty food stores (e.g., Whole Foods)—many of which are patronized by higher-income households—offered healthier checkouts. Because dollar and small grocery stores are more accessible to low-income households and communities of color [54–58], their less healthy food environments—including at checkout—may be one of the many food-environment contributors to nutritional inequities.

An important mechanism underlying the ubiquity of unhealthy foods and beverages at store checkouts observed in this study and other studies globally is marketing agreements in which ultra-processed food and beverage companies pay slotting fees to large stores and provide other benefits (e.g., discounts or free displays) to small stores to place their products at checkout [15,18,20]. Because these agreements provide strong incentives for stores to continue stocking unhealthy products at checkout, policy has been proposed as a means to improve food environments at checkout. For instance, researchers have suggested requiring Supplemental Nutrition Assistance Program-authorized retailers to keep checkouts, end-caps, and freestanding displays free of SSBs, sweets, and salty snacks, which could still be sold elsewhere in the store under such a policy [59]. Some jurisdictions have already pursued policy change. In addition to Berkeley, CA, which implemented the world's first healthy checkout policy in March 2021 (enforced

TABLE 4

Percentage of food and beverage facings that met healthy checkout standards defined by the Berkeley Healthy Checkout Ordinance and probability ratios comparing locations at checkout, store types, and staffing of checkout

	All facings	Food and beverage (FB) facings								
	n	*n* (% of facings that are FB)	Unadjusted[1]				Adjusted[1]			
			% met standards	PR of meeting standards	95% CI	*P* value	% met standards	PR of meeting standards	95% CI	*P* value
Location within checkout										
Lane and register	22,342	15,689 (70%)	35%	Ref	Ref	Ref	35%	Ref	Ref	Ref
Standalone displays	1892	1179 (62%)	26%	0.73	(0.50, 1.07)	0.108	27%	0.77	(0.52, 1.15)	0.200
Snaking	7410	4504 (61%)	23%	0.66	(0.54, 0.79)	<0.001	23%	0.64	(0.52, 0.79)	<0.001
Endcap	7742	5386 (70%)	21%	0.59	(0.46, 0.75)	<0.001	20%	0.58	(0.46, 0.73)	<0.001
Store type										
Chain supermarket	8791	6678 (76%)	35%	Ref	Ref	Ref	35%	Ref	Ref	Ref
Chain specialty food store	2547	1477 (58%)	36%	1.03[2,3]	(0.74, 1.43)	0.845	42%	1.20[2,3,4]	(0.92, 1.57)	0.183
Chain mass merchandiser	4728	3317 (70%)	34%	0.98[2,3]	(0.72 1.34)	0.904	33%	0.96[2,3]	(0.75, 1.23)	0.753
Chain drugstore	12,971	8999 (69%)	29%	0.83[2]	(0.69, 1.00)	0.050	29%	0.83[2,3,5]	(0.71, 0.96)	0.015
Independent supermarket	3053	2260 (74%)	25%	0.71	(0.51, 0.99)	0.046	26%	0.76	(0.51, 1.14)	0.189
Independent grocery	1793	1397 (78%)	20%	0.58[5,6]	(0.40, 0.85)	0.006	19%	0.56[4,5,6]	(0.39, 0.81)	0.002
Chain dollar store	5503	2630 (48%)	18%	0.51[4,5,6]	(0.38, 0.69)	<0.001	18%	0.52[4,5,6]	(0.40, 0.67)	<0.001
Staffing of checkout										
Staffed	35,981	23,962 (67%)	30%	Ref	Ref	Ref	—	—	—	—
Self-checkout	3405	2796 (82%)	29%	0.99	(0.73, 1.34)	0.945	—	—	—	—

Note: There were no significant differences in probability of meeting healthy checkout standards between snaking, standalone display, and endcap areas of checkout.

Abbreviations: FB, food and beverage; PR, probability ratio; Ref, reference.

[1] From log binomial regression models to estimate probability ratios (PR, i.e., relative risks) clustering on store and location within checkout. Adjusted models regressed a binomial indicator for meeting healthy checkout standards on indicators for location within checkout and store type. Adjusted percentages were calculated using the postregression margins command in Stata.

[2] Significantly different from chain dollar store ($P < 0.05$).

[3] Significantly different from independent grocery ($P < 0.05$).

[4] Significantly different from chain drugstore ($P < 0.05$).

[5] Significantly different from chain specialty food store ($P < 0.05$).

[6] Significantly different from chain mass merchandiser ($P < 0.05$).

January 2022), the United Kingdom implemented the first country-wide policy in October 2022 regulating the placement of foods at checkouts and other prominent locations like end of aisles and store entrances [60]; Perris, CA, recently became the second United States jurisdiction to adopt a healthy checkout policy [61], and there are several other active healthy checkout campaigns in northern California [31–33]. Rigorous evaluations of these policies are needed to provide critical evidence on their potential to improve in-store food environments, and implementation evaluations should be conducted to identify how the industry responds to these policies.

Strengths of this study include the use of a reliable tool [36] to collect detailed product and nutritional information on virtually every product facing at sampled checkouts, yielding a large sample size of 39,386 facings. The data allowed for comparisons between different locations within checkout (e.g., lane and register compared with snaking). This study also assessed a variety of store types across 4 different cities and provides novel data on the healthfulness of checkout environments in California. Limitations included not weighting results (e.g., by number of checkouts per store or store sales). Also, we did not assess gas stations or convenience stores, and the generalizability of results to other cities may be limited. However, many of the stores assessed were chains, which tend to have similar practices across geographical locations.

In conclusion, observational assessments of checkouts in 102 food stores in northern California revealed that the majority of food and beverage facings at checkout were high-added-sugar or high-sodium products, including candy, SSBs, salty snacks, and sweets. Water represented only 3% and fruits and vegetables only 1% of food and beverage facings at checkout. Furthermore, the majority of food and beverage facings (70%) did not meet the healthy checkout standards defined in Berkeley's HCO, and this percentage was even higher (89%) for smaller snack-sized packages, which may be more likely to be purchased and consumed on impulse.

Author contributions

The authors' responsibilities were as follows – JF: conceptualized the research; JF, ECW, SES, RMS, AAP, LMP: contributed to methodology and design; JF, SM, LMP: analyzed data; JF, ECW, SES, RMS: conducted research; JF: wrote paper and visualized data; JF: had primary responsibility for final content and study oversight; and all authors: edited, read, and approved the final manuscript.

Data availability

Data described in the manuscript will be made available with a data-sharing agreement that limits the use of data to only research for noncommercial purposes and prohibits the sharing of data with third parties. Data will be available after the final manuscript has been published from the larger study that generated these data.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cdnut.2023.100075.

References

[1] US Department of Agriculture and US Department of Health and Human Services, Dietary Guidelines for Americans 2020-2025. [Internet]. Available from: https://www.dietaryguidelines.gov/sites/default/files/2021-03/Dietary_Guidelines_for_Americans-2020-2025.pdf.

[2] F. Juul, N. Parekh, E. Martinez-Steele, C.A. Monteiro, V.W. Chang, Ultra-processed food consumption among US adults from 2001 to 2018, Am. J. Clin. Nutr. 115 (1) (2022) 211–221, https://doi.org/10.1093/ajcn/nqab305.

[3] L. Wang, E. Martínez Steele, M. Du, J.L. Pomeranz, L.E. O'Connor, K.A. Herrick, et al., Trends in consumption of ultraprocessed foods among US youths aged 2-19 years, 1999-2018, JAMA 326 (6) (2021) 519–530, https://doi.org/10.1001/jama.2021.10238.

[4] V.S. Malik, B.M. Popkin, G.A. Bray, J.P. Després, F.B. Hu, Sugar-sweetened beverages, obesity, type 2 diabetes mellitus, and cardiovascular disease risk, Circulation 121 (11) (2010) 1356–1364, https://doi.org/10.1161/CIRCULATIONAHA.109.876185.

[5] S.H. Ley, M.B. Schulze, M.F. Hivert, J.B. Meigs, F.B. Hu, Risk factors for type 2 diabetes, in: C.C. Cowie, S.S. Casagrande, A. Menke, M.A. Cissell, M.S. Eberhardt, J.B. Meigs, et al. (Eds.), Diabetes in America, National Institute of Diabetes and Digestive and Kidney Diseases (US), Bethesda, MD, 2018.

[6] X. Chen, Z. Zhang, H. Yang, P. Qiu, H. Wang, F. Wang, et al., Consumption of ultra-processed foods and health outcomes: a systematic review of epidemiological studies, Nutr. J. 19 (1) (2020) 86, https://doi.org/10.1186/s12937-020-00604-1.

[7] T.P. de Araújo, M.M. de Moraes, V. Magalhães, C. Afonso, C. Santos, S.S.P. Rodrigues, Ultra-processed food availability and noncommunicable diseases: a systematic review, Int. J. Environ. Res. Public Health 18 (14) (2021) 7382, https://doi.org/10.3390/ijerph18147382.

[8] N.J. Aburto, A. Ziolkovska, L. Hooper, P. Elliott, F.P. Cappuccio, J.J. Meerpohl, Effect of lower sodium intake on health: systematic review and meta-analyses, BMJ 346 (2013) f1326, https://doi.org/10.1136/bmj.f1326.

[9] J. Liu, R. Micha, Y. Li, D. Mozaffarian, Trends in food sources and diet quality among US children and adults, 2003-2018, JAMA Netw. Open 4 (4) (2021), e215262, https://doi.org/10.1001/jamanetworkopen.2021.5262.

[10] A. Drewnowski, C.D. Rehm, Consumption of added sugars among US children and adults by food purchase location and food source, Am. J. Clin. Nutr. 100 (3) (2014) 901–907, https://doi.org/10.3945/ajcn.114.089458.

[11] Z.S. Quader, L. Zhao, C. Gillespie, M.E. Cogswell, A.L. Terry, A. Moshfegh, et al., Sodium intake among persons aged ≥2 years - United States, 2013-2014, MMWR Morb. Mortal. Wkly. Rep. 66 (12) (2017) 324–328, https://doi.org/10.15585/mmwr.mm6612a3.

[12] K. Glanz, M.D. Bader, S. Iyer, Retail grocery store marketing strategies and obesity: an integrative review, Am. J. Prev. Med. 42 (5) (2012) 503–512, https://doi.org/10.1016/j.amepre.2012.01.013.

[13] A. Karpyn, K. McCallops, H. Wolgast, K. Glanz, Improving consumption and purchases of healthier foods in retail environments: a systematic review, Int. J. Environ. Res. Public Health 17 (20) (2020) 7524, https://doi.org/10.3390/ijerph17207524.

[14] R. Bennett, C. Zorbas, O. Huse, A. Peeters, A.J. Cameron, G. Sacks, et al., Prevalence of healthy and unhealthy food and beverage price promotions and their potential influence on shopper purchasing behaviour: a systematic review of the literature, Obes. Rev. 21 (1) (2020), e12948, https://doi.org/10.1111/obr.12948.
[15] A.A. Hecht, C.L. Perez, M. Polascek, A.N. Thorndike, R.L. Franckle, A.J. Moran, Influence of food and beverage companies on retailer marketing strategies and consumer behavior, Int. J. Environ. Res. Public Health 17 (20) (2020) 7381, https://doi.org/10.3390/ijerph17207381.
[16] D.A. Cohen, S.H. Babey, Candy at the cash register–a risk factor for obesity and chronic disease, N. Engl. J. Med. 367 (15) (2012) 1381–1383, https://doi.org/10.1056/NEJMp1209443.
[17] D.A. Cohen, S.H. Babey, Contextual influences on eating behaviours: heuristic processing and dietary choices, Obes Rev 13 (9) (2012) 766–779, https://doi.org/10.1111/j.1467-789X.2012.01001.x.
[18] Center for Science in the Public Interest (CSPI) [Internet], G. Rivlin, Rigged: supermarket shelves for sale (2016) [cited January 27, 2021]. Available from: https://cspinet.org/resource/rigged.
[19] J. Falbe, J.S. White, D.M. Sigala, A.H. Grummon, S.E. Solar, L.M. Powell, The potential for healthy checkout policies to advance nutrition equity, Nutrients 13 (11) (2021) 4181, https://doi.org/10.3390/nu13114181.
[20] G.X. Ayala, H. D'Angelo, J. Gittelsohn, L. Horton, K. Ribisl, L.S. Sindberg, et al., Who is behind the stocking of energy-dense foods and beverages in small stores? The importance of food and beverage distributors, Public Health Nutr 20 (18) (2017) 3333–3342, https://doi.org/10.1017/S1368980016003621.
[21] L.E. Thornton, A.J. Cameron, S.A. McNaughton, W.E. Waterlander, M. Sodergren, C. Svastisalee, et al., Does the availability of snack foods in supermarkets vary internationally? Int. J. Behav. Nutr. Phys. Act. 10 (2013) 56, https://doi.org/10.1186/1479-5868-10-56.
[22] D.A. Cohen, R. Collins, G. Hunter, B. Ghosh-Dastidar, T. Dubowitz, Store impulse marketing strategies and body mass index, Am. J. Public Health 105 (7) (2015) 1446–1452, https://doi.org/10.2105/AJPH.2014.302220.
[23] T.L. Barnes, J.E. Pelletier, D.J. Erickson, C.E. Caspi, L.J. Harnack, M.N. Laska, Healthfulness of foods advertised in small and nontraditional urban stores in Minneapolis-St. Paul, Minnesota, 2014, Prev. Chronic Dis. 13 (2016) E153, https://doi.org/10.5888/pcd13.160149.
[24] H. Gebauer, M.N. Laska, Convenience stores surrounding urban schools: an assessment of healthy food availability, advertising, and product placement, J. Urban Health 88 (4) (2011) 616–622, https://doi.org/10.1007/s11524-011-9576-3.
[25] D.A. Cohen, L. Bogart, G. Castro, A.D. Rossi, S. Williamson, B. Han, Beverage marketing in retail outlets and The Balance Calories Initiative, Prev. Med. 115 (2018) 1–7, https://doi.org/10.1016/j.ypmed.2018.07.014.
[26] D. Barker, C. Quinn, L. Rimkus, C. Mineart, S. Zenk, F. Chaloupka, Availability of Healthy Food Products at Check-Out Nationwide, 2010–2012. A BTG Research Brief. Bridging the Gap Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago, Chicago, IL, 2015.
[27] P. Fielding-Singh, J. Almy, M.C. Wootan, Sugar overload: retail checkout promotes obesity [Internet], Center for Science in the Public Interest, 2014 [cited April 4, 2021]. Available from: https://cspinet.org/resource/sugar-overload-retail-checkout-promotes-obesity.
[28] [Internet], Ordinance 7734-NS, 2020. Available from: https://berkeley.municipal.codes/BMC/9.82.050.
[29] K.T. Ejlerskov, M. Stead, A. Adamson, M. White, J. Adams, The nature of UK supermarkets' policies on checkout food and associations with healthfulness and type of food displayed: cross-sectional study, Int. J. Behav. Nutr. Phys. Act. 15 (1) (2018) 52, https://doi.org/10.1186/s12966-018-0684-2.
[30] K.T. Ejlerskov, S.J. Sharp, M. Stead, A.J. Adamson, M. White, J. Adams, Supermarket policies on less-healthy food at checkouts: natural experimental evaluation using interrupted time series analyses of purchases, PLOS Med 15 (12) (2018), e1002712, https://doi.org/10.1371/journal.pmed.1002712.
[31] City of Richmond, CA, Healthy retail ordinance [Internet], 2022 [updated 2022; cited March 26, 2023]. Available from: https://www.ci.richmond.ca.us/4200/Healthy-Retail-Ordinance.
[32] Contra Costa County Board of Supervisors, Family & Human Services Committee, Februrary 27, 2023 [Internet], agenda (2023) [updated Februrary 2023; cited March 26, 2023]. Available from: http://64.166.146.245/agenda_publish.cfm?id=&mt=ALL&get_month=2&get_year=2023&dsp=ag&seq=2169.
[33] Bay Area Community Resources, Engaging communities in advocacy and policy: individuals, families, and communities [Internet], 2023 [updated 2022; cited March 26, 2023]. Available from: https://www.bacr.org/ecap.
[34] Infogroup, Inc, ReferenceUSA [Internet], 2020 [cited December 7, 2020]. Available from: http://www.referenceusa.com/Static/About Us.
[35] J. Falbe, M.M. Lee, S. Kaplan, N.A. Rojas, A.M. Ortega Hinojosa, K.A. Madsen, Higher sugar-sweetened beverage retail prices after excise taxes in Oakland and San Francisco, Am. J. Public Health110 (7) (2020) 1017–1023, https://doi.org/10.2105/AJPH.2020.305602.
[36] L.M. Powell, Y. Li, S.E. Solar, A.A. Pipito, E.C. Wolf, J. Falbe, Development and Reliability Testing of a Store CheckOUt Tool (SCOUT) for Use in Healthy Checkout Evaluations, Policy, Practice and Prevention Research Center, University of Illinois at Chicago, Chicago, IL, 2022. March. Report No.: Research Brief No. 125.
[37] R. Coelho do Vale, R. Pieters, M. Zeelenberg, Flying under the radar: perverse package size effects on consumption self-regulation, J. Consum. Res. 35 (3) (2008) 380–390, https://doi.org/10.1086/589564.
[38] T.A. Farley, E.T. Baker, L. Futrell, J.C. Rice, The ubiquity of energy-dense snack foods: a national multicity study, Am. J. Public Health 100 (2) (2010) 306–311, https://doi.org/10.2105/AJPH.2009.178681.
[39] A. Whitehouse, A. Simon, S.A. French, J. Wolfson, Availability of snacks, candy and beverages in hospital, community clinic and commercial pharmacies, Public Health Nutr 15 (6) (2012) 1117–1123, https://doi.org/10.1017/S1368980011003600.
[40] C.H. Basch, W.D. Kernan, A. Menafro, Presence of candy and snack food at checkout in chain stores: results of a pilot study, J. Community Health 41 (5) (2016) 1090–1093, https://doi.org/10.1007/s10900-016-0193-7.
[41] C.H. Basch, J. Fera, Candy, snack food, and soda in the checkout lines of stores selling products for children in New York City, J. Community Health 46 (2021) 922–926, https://doi.org/10.1007/s10900-021-00975-4.
[42] H. Dixon, M. Scully, K. Parkinson, Pester power: snackfoods displayed at supermarket checkouts in Melbourne, Australia, Health Promot, J. Austr. 17 (2) (2006) 124–127, https://doi.org/10.1071/he06124.
[43] L.E. Thornton, A.J. Cameron, S.A. McNaughton, A. Worsley, D.A. Crawford, The availability of snack food displays that may trigger impulse purchases in Melbourne supermarkets, BMC Public Health 12 (2012) 194, https://doi.org/10.1186/1471-2458-12-194.
[44] A.J. Cameron, The shelf space and strategic placement of healthy and discretionary foods in urban, urban-fringe and rural/non-metropolitan Australian supermarkets, Public Health Nutr 21 (3) (2018) 593–600, https://doi.org/10.1017/S1368980017003019.
[45] L. Grigsby-Duffy, S. Schultz, L. Orellana, E. Robinson, A.J. Cameron, J. Marshall, et al., The healthiness of food and beverages on price promotion at promotional displays: a cross-sectional audit of Australian supermarkets, Int. J. Environ. Res. Public Health 17 (23) (2020) 9026, https://doi.org/10.3390/ijerph17239026.
[46] S. Schultz, A.J. Cameron, L. Grigsby-Duffy, E. Robinson, J. Marshall, L. Orellana, et al., Availability and placement of healthy and discretionary food in Australian supermarkets by chain and level of socio-economic disadvantage, Public Health Nutr 24 (2) (2021) 203–214, https://doi.org/10.1017/S1368980020002505.
[47] J.A. Horsley, K.A. Absalom, E.M. Akiens, R.J. Dunk, A.M. Ferguson, The proportion of unhealthy foodstuffs children are exposed to at the checkout of convenience supermarkets, Public Health Nutr 17 (11) (2014) 2453–2458, https://doi.org/10.1017/S1368980013003571.
[48] J. Wright, E. Kamp, M. White, J. Adams, S. Sowden, Food at checkouts in non-food stores: a cross-sectional study of a large indoor shopping mall, Public Health Nutr 18 (15) (2015) 2786–2793, https://doi.org/10.1017/S1368980015000178.
[49] C.C.V. Lam, K.T. Ejlerskov, M. White, J. Adams, Voluntary policies on checkout foods and healthfulness of foods displayed at, or near, supermarket checkout areas: a cross-sectional survey, Public Health Nutr 21 (18) (2018) 3462–3468, https://doi.org/10.1017/S1368980018002501.
[50] E.A. Campbell, M.J. Shapiro, C. Welsh, S.N. Bleich, L.K. Cobb, J. Gittelsohn, Healthy food availability among food sources in rural Maryland counties, J. Hunger Environ. Nutr. 12 (3) (2017) 328–341, https://doi.org/10.1080/19320248.2017.1315328.
[51] T.A. Farley, J. Rice, J.N. Bodor, D.A. Cohen, R.N. Bluthenthal, D. Rose, Measuring the food environment: shelf space of fruits, vegetables, and snack foods in stores, J. Urban Health 86 (5) (2009) 672–682, https://doi.org/10.1007/s11524-009-9390-3.

[52] M.N. Laska, K.E. Borradaile, J. Tester, G.D. Foster, J. Gittelsohn, Healthy food availability in small urban food stores: a comparison of four US cities, Public Health Nutr 13 (7) (2010) 1031–1035.
[53] S.N. Zenk, L.M. Powell, L. Rimkus, Z. Isgor, D.C. Barker, P. Ohri-Vachaspati, et al., Relative and absolute availability of healthier food and beverage alternatives across communities in the United States, Am. J. Public Health 104 (11) (2014) 2170–2178, https://doi.org/10.2105/AJPH.2014.302113.
[54] S. Brown-Amilian, Dollar store access in the St. Louis Metropolitan Area, MO-IL, USA, Pap Appl Geog 8 (4) (2022) 483–492, https://doi.org/10.1080/23754931.2022.2071128.
[55] J. Shannon, Dollar stores, retailer redlining, and the metropolitan geographies of precarious consumption, Ann. Am. Assoc. Geogr. 111 (4) (2021) 1200–1218, https://doi.org/10.1080/24694452.2020.1775544.
[56] L.M. Powell, S. Slater, D. Mirtcheva, Y. Bao, F.J. Chaloupka, Food store availability and neighborhood characteristics in the United States, Prev. Med. 44 (3) (2007) 189–195, https://doi.org/10.1016/j.ypmed.2006.08.008.
[57] K.A. Madsen, J. Falbe, G. Olgin, A. Ibarra-Castro, N. Rojas, Purchasing patterns in low-income neighbourhoods: implications for studying sugar-sweetened beverage taxes, Public Health Nutr 22 (10) (2019) 1807–1814, https://doi.org/10.1017/S1368980019000375.
[58] J.E. Todd, B. Scharadin, Where households get food in a typical week: findings from USDA's FoodAPS [Internet], United States Department of Agriculture, 2016. Available from: https://www.ers.usda.gov/publications/pub-details/?pubid=80541.
[59] A.N. Thorndike, C.R. Sunstein, Obesity prevention in the supermarket-choice architecture and the Supplemental Nutrition Assistance Program, Am. J. Public Health 107 (10) (2017) 1582–1583, https://doi.org/10.2105/AJPH.2017.303991.
[60] The Food (Promotion and Placement) (England) Regulations 1368, UK Statutory Instruments, 2021. No. 1368, Stat.
[61] City of Perris, Perris passes ordinance for healthier options at checkout lanes [Internet], 2023 [updated March 6, 2023; cited March 26, 2023]. Available from: https://www.cityofperris.org/Home/Components/News/News/150/15.