Public Health

A novel marketing mix and choice architecture framework to nudge restaurant customers toward healthy food environments to reduce obesity in the United States

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Summary

This review identified and adapted choice architecture frameworks to develop a novel framework that restaurant owners could use to promote healthy food environments for customers who currently overconsume products high in fat, sugar and sodium that increase their risk of obesity and diet-related non-communicable diseases. This review was conducted in three steps and presented as a narrative summary to demonstrate a proof of concept. Step 1 was a systematic review of nudge or choice architecture frameworks used to categorize strategies that cue healthy behaviours in microenvironments. We searched nine electronic databases between January 2000 and December 2016 and identified 1,244 records. Inclusion criteria led to the selection of five choice architecture frameworks, of which three were adapted and combined with marketing mix principles to highlight eight strategies (i.e. *place*, *profile*, *portion*, *pricing*, *promotion*, healthy default *picks*, *prompting or priming* and *proximity*). Step 2 involved conducting a comprehensive evidence review between January 2006 and December 2016 to identify U.S. recommendations for the restaurant sector organized by strategy. Step 3 entailed developing 12 performance metrics for the eight strategies. This framework should be tested to determine its value to assist restaurant owners to promote and socially normalize healthy food environments to reduce obesity and non-communicable diseases.

Keywords: choice architecture, healthy food environments, marketing mix, restaurants.

Introduction

The restaurant industry in the United States (U.S.) and globally is highly competitive, dynamic and profitable. The National Restaurant Association projected U.S. sales to exceed $780 billion in 2016 (1) (Table 1). The top 20 U.S.-headquartered quick-service (QSR), fast-casual (FCR) and full-service restaurant (FSR) chains generated over $155 billion dollars between 2015 and 2016 (2). Several U.S.-headquartered chains (i.e. McDonald's, Subway, Yum! Brands, Burger King and Domino's Pizza) operate franchise businesses in 70 to 100 countries worldwide (3–7). Table 1 provides definitions of commonly used terms to describe the restaurant sector.

Recent marketing research suggests that nearly two-thirds of Americans visit fast food restaurants (hereafter called QSRs) and 40% visit FCRs every week (8). Yet half of Americans struggle to find healthy options at restaurants (9). An international study of adults across 10 countries found that less than 20% were satisfied with healthy restaurant menu options (10). Extensive evidence reveals that people's consumption of food and beverage products

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Table 1 Top 20 ranking of restaurant companies by U.S. system-wide sales, 2015–2016

Rank[1]	*Restaurant chain*[2] company	Headquarters city, state	2015–2016 U.S. system-wide sales $U.S. billion
1	*McDonald's* McDonald's Corp.	Oak Brook, IL	$35.84
2	*Starbucks* Starbucks Corp.	Seattle, WA	$15.95
3	*Subway* Doctor's Associates Inc.	Milford, CT	$11.50
4	*Burger King* Restaurant Brands International Inc.	Miami-Dade County, FL	$9.12
5	*Wendy's* The Wendy's Co.	Dublin, OH	$9.01
6	*Taco Bell* Yum! Brands Inc.	Irvine, CA	$8.82
7	*Dunkin' Donuts* Dunkin' Brands Group Inc.	Canton, MA	$7.62
8	*Chick-fil-A* Chick-fil-A Inc.	Atlanta, GA	$6.75
9	*Pizza Hut* Yum! Brands, Inc.	Louisville, KY	$5.80
10	*Domino's* Domino's Pizza Inc.	Ann Arbor, MI	$4.81
11	*Applebee's Neighborhood Grill & Bar* DineEquity Inc.	Kansas City, MO	$4.74
12	*Panera Bread* Panera Bread Co.	St. Louis, MO	$4.59
13	*Chipotle Mexican Grill* Chipotle Mexican Grill Inc.	Denver, CO	$4.44
14	*Sonic America's Drive-In* Sonic Corp.	Oklahoma City, OK	$4.37
15	*KFC* Yum! Brands Inc.	Louisville, KY	$4.33
16	*Olive Garden* Darden Restaurants Inc.	Orlando, FL	$3.82
17	*Chili's Grill & Bar* Brinker International Inc.	Dallas, TX	$3.62
18	*Buffalo Wild Wings Grill & Bar* Buffalo Wild Wings Inc.	Minneapolis, MI	$3.58
19	*Little Caesars* Little Caesar Enterprises Inc.	Detroit, MI	$3.55
20	*Dairy Queen* Berkshire Hathaway Inc.	Edina, MN	$3.51
	U.S. system-wide sales		$155.77

Sources: References (1), (2) and (8).

Notes

[2]Limited-service restaurants (LSRs) represent two types of restaurant sectors: fast-food restaurants or quick-service restaurants (QSRs) and fast-casual restaurants (FCRs).

Quick-service restaurants (QSRs) are defined as 'restaurants with minimal service where food is supplied quickly after ordering'. Examples of QSRs include McDonald's, Burger King and Wendy's.

Fast-casual restaurants (FCRs) are defined as 'restaurants that offer limited table service or self-service, higher quality food and upscale décor than LSRs, and higher-priced checks between $8 and $15'. Examples of FCRs include Starbucks, Panera Bread, Chipotle and Domino's Pizza

Full-service restaurants (FSRs) are defined as 'restaurants that offer full table service, are family friendly, and entrée prices are usually under $20 per person'. Examples of FSRs include Applebee's, Olive Garden and Silver Diner.

[3]*Chain restaurants* that operate businesses at more than 20 locations under shared corporate ownership or franchising agreements in the United States.

Non-chain restaurants are independently owned businesses that operate at fewer than 20 locations in the United States.

Sources

[1]National Restaurant Association. *2016 Restaurant Industry Forecast*. February 2016.

[2]2015 Top 100: U.S. Chain Systemwide Sales. *Nation's Restaurant News*. 20 June 2016.

[8]Technomic, Inc. *Future of LSR: Fast-Food & Fast-Casual Restaurants. Consumer Trend Report*. 2014.

sold by or purchased at FSRs and limited-service restaurants (LSRs), which include QSRs and FCRs, are high in fat, sugar and sodium (HFSS), which is associated with poor diet quality and increased risk of obesity and diet-related non-communicable diseases (NCDs) (11–19).

In 2014, more than two-thirds (70.7%) of American adults were overweight or obese (20), and 32.4% of American children and adolescents, ages 2–19 years, were overweight or obese (21). Nearly 2.7 billion adults will be overweight or obese worldwide by 2025 (22). Reducing the frequency and amount of HFSS restaurant offerings may help to reduce obesity and NCD risks, especially among children and adolescents (23).

Restaurant owners and managers currently use marketing mix principles (i.e. product, place, price and promotion) to build corporate brand awareness and loyalty among individuals who purchase and consume products that generate revenue to maximize company profits (24,25). Wansink (26) has emphasized the importance of restaurants using marketing principles to make healthy food and beverage choices more *convenient* (to see, order, pick up and consume); *attractive* (via name, appearance, price and expectations); and *normal* (to order, purchase, serve and eat) to promote healthy dietary goals among individuals and populations. However, restaurant owners do not comprehensively combine marketing mix principles with choice architecture strategies, which include interventions that design choices in different ways to influence people's decision-making and behaviours in micro-environments.

Nudging is defined by Thaler and Sunstein (27) as '*Any aspect of choice architecture that alters people's behavior in predictable ways without restricting any options or significantly changing their economic incentives such as time or money.*' Nudge theory is rooted in decades of research in psychology and behavioural economics to change people's behaviours. Nudge theory also advances the concept of libertarian paternalism, an ideological view that favours the use of people's cognitive biases and 'rules of thumb' to facilitate decision-making in the marketplace. Policymakers and government officials are using nudge interventions to influence and improve people's lives without restricting their choices (28,29).

Choice architecture or nudge strategies, which are also called 'hidden forms of persuasion' and 'smart default choices' (30), represent soft policy approaches used by governments and businesses to cue healthy behaviours that are undermined by unhealthy food and eating environments (31–36). One goal of this approach is to create healthy food environments that represent the economic, policy and sociocultural conditions, sectors and settings that offer people access to healthy and affordable foods and beverages to prevent or help reduce the prevalence of obesity and diet-related NCDs (37).

Choice architecture strategies have been tested in many settings (e.g. schools, hospitals, worksites, food retail outlets and restaurants) where people live, learn, shop, work and play (38–43). Experimental studies have shown mixed effectiveness for several reasons. First, most studies have focused on one or two strategies at a time, rather than implementing comprehensive integrated nudge interventions. Second, interventions were of short duration that hindered judgements about their long-term sustainability and effectiveness. Third, studies have had weak methodological designs. Finally, results have depended upon the dietary-choice setting or demographic factors, such as cultural preferences or education (44–46).

Critics argue that nudge interventions have substantial limitations when used without government legislation and regulation and provide only marginal benefits for populations (47,48). Another shortcoming is that nudge or choice architecture strategies exclude pricing manipulations that are a classic feature of the conventional commercial marketing mix (24,25) used to influence people's health-related purchasing and consumption behaviours.

Some systematic reviews have identified pricing and fiscal strategies as essential interventions to reduce socio-economic inequities and promote healthy eating to decrease obesity and NCD risks (49,50). An additional limitation of certain nudge strategies that provide people with food labelling information to inform their purchases (called priming or prompting) is that competing factors such as taste, cost and targeted marketing often overpower their rational thinking to choose unhealthy over the healthiest food and beverage options (30,51).

In response to weaknesses of nudge strategies discussed earlier, certain public health advocacy groups have proposed that government implement legislation and regulations to accelerate the U.S. restaurant sector to implement coordinated actions to provide healthy offerings to customers (52,53). Proposed solutions are to (1) enact healthy zoning ordinances to limit the location, number or density of chain restaurants located near settings frequented by children and adolescents such as child-care facilities, schools, playgrounds and other public venues; (2) implement a healthy restaurant health-rating programme to establish nutrition standards for children's meals at restaurants; (3) prohibit chain restaurants from using toy incentives or other premiums to sell products to children or teens that do not meet specific nutrition standards; (4) regulate outdoor advertising or signage of chain restaurants to promote the healthiest options; and (5) enact legislation to eliminate tax deductions for restaurants that use television advertising for products that do not meet healthy nutrition guidelines.

Nudging represents only one form of choice architecture, whereas coercion and inducements are alternative choice architecture strategies or hard policy tools that governments could use to influence population health (54). Nevertheless,

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government agencies in the U.S. and other countries have been reluctant to use legislative and regulatory tools to compel the restaurant sector to make substantial changes to promote healthy default food and beverage choices for customers. Evaluations have found limited public support for healthy zoning ordinances and the elimination of tax deductions for restaurants that advertise unhealthy food products to children; and either a modest reduction or no measurable impact on the reduction of unhealthy weight gain among targeted populations (53,55,56).

Study purpose

Given the current neoliberal and de-regulatory governance preferences of many national governments, there is a need to identify ways to encourage and hold food, beverage and restaurant industry stakeholders accountable for expanding the breadth and scope of voluntary actions to promote healthy food environments (37). One potential solution may involve the restaurant sector combining marketing mix (i.e. product, place, price and promotion) and nudge strategies to facilitate healthy dietary choices for people who are at risk of developing obesity and diet-related NCDs. This issue is especially relevant for children and adolescents due to their frequency of fast food consumption and proportion of calories consumed from restaurants and the need to target their parents who serve as role models and mediators of choice for young people.

No study has examined the combination of voluntary marketing mix principles and choice architecture or nudge strategies for the restaurant sector to promote healthy food environments. This study addresses this critical knowledge gap with the goal of developing a policy-relevant marketing mix and choice architecture framework, along with performance metrics, which restaurant owners can potentially use to promote and socially normalize healthy dietary choices for customers. This framework can also be used by government and civil society organizations to monitor and evaluate progress in order to hold restaurant owners accountable for accelerating comprehensive actions to reduce obesity and diet-related NCDs among the U.S. population.

Methods

This study was conducted in three steps and guided by three research questions (RQs):

RQ1: What types of choice architecture or nudge models, frameworks or classification systems can be adapted and combined with marketing mix interventions to develop a comprehensive set of evidence-informed marketplace actions for the restaurant sector to promote healthy food environments for children, adolescents and parents?

RQ2: What recommendations have been issued by authoritative U.S. government, industry and interdisciplinary expert bodies to help the U.S. restaurant sector promote healthy food environments for children, adolescents and parents?

RQ3: What performance metrics can be used to evaluate U.S. restaurant-sector progress to offer healthy food and beverage choices that promote healthy food environments for children, adolescents and parents?

RQ1 search strategy, evidence extraction and synthesis

To address RQ1, the lead author worked with an academic liaison librarian, with input from three co-investigators, to design and execute a systematic literature review over a 15-year period implemented between August 1, 2016 and December 31, 2016. This process began with a hand search of reference lists of published reviews found in interdisciplinary journals (i.e. public health, nutrition, public policy, behavioural economics, psychology and advertising or marketing) to develop a search strategy to describe and conceptualize choice architecture and nudge interventions that influence diet-related and health-related behaviours. Thereafter, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol 2015 checklist (57) to design and conduct a review of nine electronic peer-reviewed databases (i.e. ABI/INFORM, Business Source Complete, CINAHL, Health Source, Political Science Complete, PsychInfo, PubMed, SocIndex and Web of Science) and Google Scholar (first 50 search hits) in the English language between January 1, 2000 and December 31, 2016.

The pre-defined search terms of subject headings and text words used across all the databases included: ('choice architecture' OR 'choice-architecture' OR nudge OR nudges) AND (model* OR framework* OR theor* OR typolog* OR taxonom* OR method* OR technique* OR tool* OR criteria OR classification*) AND (behavior* OR decision*). Articles were eligible for inclusion if they met the following criteria: (1) published in English in scholarly peer-reviewed journals between January 1, 2000 and December 31, 2016; (2) defined the terms 'choice architecture' or 'nudge' as behavioural economic strategies to cue healthy dietary behaviours; and (3) described a specific model, framework, typology, taxonomy or classification system that used choice architecture or nudging to change micro-environments to improve the diet, lifestyle and/or health-related outcomes of individuals or populations.

RQ2 search strategy, evidence extraction and synthesis

To address RQ2, the lead investigator worked with an independent reviewer to conduct a comprehensive evidence review of the peer-reviewed and grey literature from 2000 to

2016 to identify and compile key reports and recommendations for the U.S. restaurant sector to improve the healthfulness of products served and sold to customers using the eight voluntary marketing mix and nudge strategies identified earlier. The authoritative bodies were (1) interdisciplinary expert panels (i.e. Health and Medicine Division of the National Academy of Medicine, National Institutes of Health and RAND Corporation and Robert Wood Johnson Foundation's Healthy Eating Research expert panel); (2) U.S. government agencies, task forces or cross-sectoral partnerships (i.e. Food and Drug Administration [FDA] and Keystone Center, Federal Trade Commission, White House Task Force on Childhood Obesity and the National Salt Reduction Initiative); and (3) industry trade organizations or self-regulatory programs (i.e. Children's Food and Beverage Advertising Initiative and the National Restaurant Association and Healthy Dining).

The pre-defined search terms used for the RO2 literature search included restaurant* AND (nutrition OR nutritious OR health OR healthy OR health-related OR diet OR dietary OR diets) AND (choice OR nudge OR ambience OR atmospher* OR place OR profile OR priming OR promotion OR promoting OR prompting OR proximity OR portion OR price OR prices OR pricing OR cost OR 'product placement' OR 'business practices' OR choice architecture).

The lead author extracted relevant recommendations and categorized them into an evidence table (Table S1)

according to the eight strategies into an adapted marketing mix and nudge framework that the co-investigators independently reviewed.

RQ3 evidence synthesis

To address RQ3, the lead author reviewed and combined the recommendations from Table S1 into 12 performance metrics for the eight marketing mix and nudge strategies. The four co-investigators independently reviewed and discussed the recommendations until we reached consensus for each performance metric. Figure 2 depicts the eight strategies operationalized in a visual format to provide examples for how U.S. chain and non-chain restaurants could use each strategy to promote healthy food environments for all customers including children, adolescents and parents. Given the diverse nature and breadth of the evidence acquired, we present the findings as a narrative summary.

Results

RQ1A: identification of choice architecture conceptual models, typologies or frameworks

Figure 1 shows the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol diagram for the systematic literature review. A total of 1,257 articles were
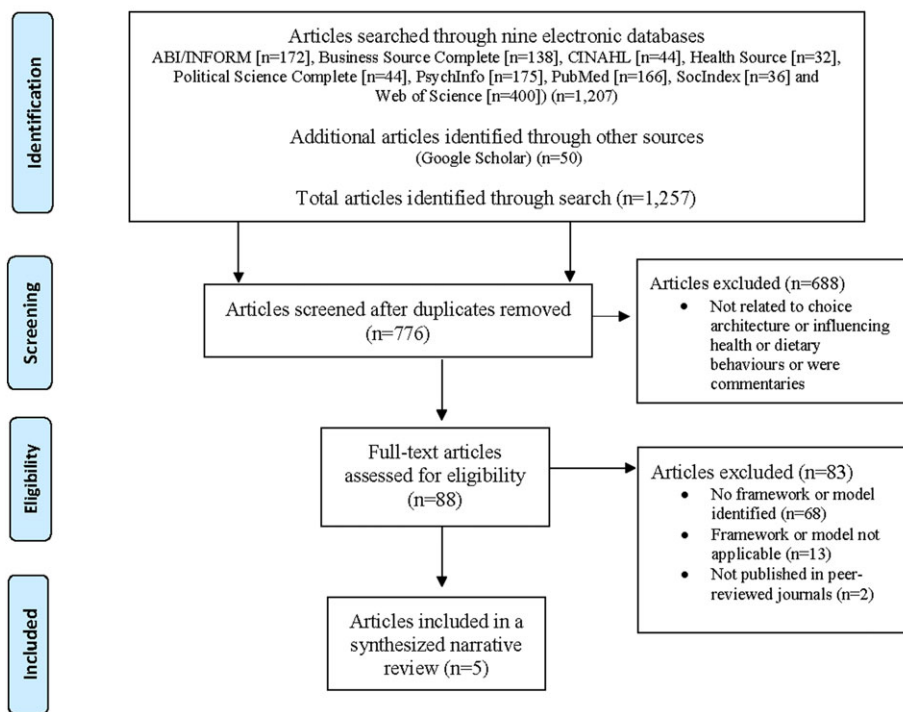
Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol diagram for the systematic review of choice architecture or nudge models, frameworks and typologies. [Colour figure can be viewed at wileyonlinelibrary.com]

identified through the literature search of nine electronic databases (*n* = 1,207) and Google Scholar (*n* = 50) and imported into an EndNote citation manager library. Following the identification and removal of duplicate records, 776 articles remained. The title and abstract of each article was screened by two independent reviewers for inclusion based on the eligibility criteria, and 688 articles were excluded. Following the title and abstract review, 88 full-text records were reviewed, after which 83 records were excluded. Disagreements among reviewers were settled by consensus. Articles that had duplicated the reporting of frameworks or typologies from earlier investigators were excluded from the final review. Five articles met the inclusion criteria described in the narrative synthesis below. Table 2 provides a text summary, while the Fig. S1 illustrates the features of the choice architecture or nudge conceptual frameworks, models or typologies identified through the systematic review. Figure 2 provides an illustration of each choice architecture framework, model or typology selected from the systematic literature review.

The first framework was proposed by Hollands *et al.* (58) who observed a '*lack of operationalized definitions and conceptual clarity between different research disciplines concerning the application of choice architecture to public health interventions*'. These investigators offered a typology of three intervention classes to help researchers translate findings into policies and actions that could cue healthy behaviours across different micro-environments. The first class proposed alterations to the properties of objects or stimuli with five strategies (i.e. ambience, functional design, labelling, presentation and sizing); the second class proposed alterations to the placement of objects or stimuli with two strategies (i.e. availability and proximity); and the third class proposed changes to both the properties and placement of objects or stimuli with two nudge strategies (i.e. priming and prompting). This typology was developed based on a large-scale scoping evidence review (*n* = 440 studies) of the effects of choice architecture interventions on diet, physical activity, alcohol and tobacco behaviours within micro-environments (58).

The second framework was proposed by Munscher *et al.* (59) and offered a taxonomy of three intervention categories and nine strategies to influence decision information (i.e. translate or simplify information, make information more visible and describe descriptive norms or social reference points); influence the decision structure (i.e. change the choice defaults or option-related efforts, enhance the composition of options or emphasize the option consequences for individuals); and highlight the decision assistance (i.e. provide reminders and facilitate people's commitments). This taxonomy was developed based on a selective non-systematic review of empirical examples of choice architecture interventions.

The third framework was proposed by Gittelsohn and Lee (60) that combined educational, environmental and behavioural economic strategies to influence the distal, proximal and downstream food choices of consumers. These authors proposed four nudge strategies including the enhancement of convenience, anchoring (i.e. relative placement or pricing of food products), defaults to address *status quo* bias (i.e. opt-out for unhealthy options) and choice framing (i.e. loss or gain). The authors acknowledged differences among the proposed strategies for psychological decision-making. Environmental strategies were suggested to address distal or upstream societal factors in macro-environments, educational strategies to address the somewhat proximal factors related to people's decision-making in both macro and micro-environments and behavioural-economic strategies to address the proximal factors that influence people's decisions in micro-environments (60).

The fourth framework proposed by Hansen *et al.* (61) that uniquely focused on the ethical acceptability and implications of government or businesses using nudge strategies. This framework offered two distinctions (i.e. transparent versus non-transparent manipulation of choices; and reflective versus automatic with regard to responsibility). The framework was based on a selective non-systematic review of the public health and policy literature and highlighted the ethical dimensions and potential side effects of individual autonomy and the responsibilities and expectations held by individuals targeted by nudge interventions.

The fifth framework was proposed by Vlaev *et al.* (62) that described the United Kingdom's Behavioral Insights Nudge Unit's framework for behaviour change developed in 2010. The MINDSPACE framework offered nine factors (i.e. messenger, incentives, norms, defaults, salience, priming, affect, commitments and ego) that influence the brain and psychological behaviours of individuals and populations and have different implications for nudge strategies (Fig. S1). The development of this fifth framework was based on a non-systematic review of behavioural economics theory and literature and was proposed for use by policymakers, public administrators and businesses to influence the health-related behaviours of populations.

RQ1B: adaptation of choice architecture or nudge frameworks for the restaurant sector

Three of the five frameworks (58–60) shared similarities in how nine possible choice architecture or nudge strategies were categorized, amenable to adaptation and combination with the marketing mix strategies (i.e. product, place, price and promotion). The other two frameworks were less relevant to the study goal given that Hansen *et al.* (61) examined ethical issues related to using nudge strategies (61), and the MINDSPACE framework described by Vlaev

Table 2 Summary of the choice architecture or nudge frameworks, models and typologies to influence diet-related behaviours identified through the systematic review

	Hollands *et al.* (58)	Munscher *et al.* (59)	Gittlesohn and Lee (60)	Hansen *et al.* (61)	Vlaev *et al.* (62)
Title	Typology of choice architecture interventions	Taxonomy of choice architecture techniques	Conceptual model of multi-frame approach for improving dietary interventions	Framework to accept the ethical acceptability and implications of nudges	Behavioral Insights Team MINDSPACE framework for behaviour change
Definition of choice architecture	Choice architecture refers to interventions that alter the properties or placement of objects or stimuli within micro-environments to change health-related behaviour	Choice architecture refers to changes in the decision environment that can affect individual decision-making and behaviour while preserving freedom of choice	By interacting with individual choices and responding to environmental cues, behavioural economic strategies can subtly nudge individuals toward healthy behaviours	Choice architecture or a nudge is a function of any attempt at influencing people's judgement, choice or behaviour in a predictable way that is made possible because of cognitive boundaries, biases, routines and habits in individual and social decision-making posing barriers for people to perform rationally in their own self-declared interests and that works by making use of those boundaries, biases, routines and habits as integral parts of such attempts	The environments in which people make choices that involve automatic processes (minimal conscious engagement) but does not exclude conscious and reflective processes
Framework description 1. categories/classes 2. strategies/techniques	Three intervention classes that include: 1. Alter the properties of objects or stimuli (i.e. ambience, functional design, labelling, presentation and sizing) 2. Alter the placement of objects or stimuli (i.e. availability and proximity) 3. Alter both the properties and placement of objects or stimuli (i.e. priming and *prompting*)	Three intervention categories to change: 1. Decision information (i.e. translate information through reframing or simplification; making information more visible; and providing descriptive norms or social reference points); 2. Decision structure (i.e. change choice defaults, change option-related efforts, change the composition of options, and option consequences); and 3. Decision assistance (i.e. provide reminders, facilitate commitment)	Three approaches for behaviour change: 1. Environmental (i.e. availability, affordability, location and transportation) 2. Education (i.e. point-of-purchase promotions [signage]; community promotion, interactive sessions or classes; handouts [i.e. fliers or brochures] and media [radio or television]) 3. Behavioural economics (i.e. convenience, anchoring [relative placement or pricing], defaults [i.e. opt out for unhealthier options] and framing [i.e. loss or gain])	This framework makes two distinctions – transparent versus non-transparent manipulation of choices, and reflective versus automatic with regard to responsibility – in order evaluate the ethics of possible side effects with regard to autonomy	The MINDSPACE framework offers nine factors that influence the brain and psychological behaviours of individuals and populations including: Messenger Incentives Norms Defaults Salience Priming Affect Commitment Ego
Basis for development	Based on a comprehensive scoping review of choice architecture interventions to change diet ($n = 309/440$ studies); physical activity ($n = 84/440$	Based on a review of empirical examples of nudge and choice architecture interventions	Based on the empirical evidence of three case studies from healthy food-retail interventions in the United States	Based on a selected review of the public health and policy literature	Based on a review of behavioural economics theory and a body of literature on automatic and contextual effects of interventions on behaviour

(*Continues*)

Table 2 (Continued)

	Hollands *et al.* (58)	Munscher *et al.* (59)	Gittlesohn and Lee (60)	Hansen *et al.* (61)	Vlaev *et al.* (62)
Title	Typology of choice architecture interventions	Taxonomy of choice architecture techniques	Conceptual model of multi-frame approach for improving dietary interventions	Framework to accept the ethical acceptability and implications of nudges	Behavioral Insights Team MINDSPACE framework for behaviour change
Target groups	studies); alcohol use (*n* = 32/440 studies); and tobacco use (15/440 studies) Researchers to investigate the effectiveness of choice architecture interventions within environments to influence consumer behaviours	Researchers and policymakers to influence consumer behaviours	Food retailers to influence consumer behaviours	Policymakers and public health decision-makers to influence consumer behaviours	Policymakers, public administrators, civil servants, public health practitioners, charities, businesses and local authorities to influence consumer behaviours

et al. (62) focused on individual behaviour strategies and the underlying psychological processes that explain these behaviours. We combined the features of the three frameworks described previously to develop a hybrid marketing mix and choice architecture framework that emphasized four marketing mix interventions and four choice architecture strategies divided into two intervention categories. Table 3 shows the combined and adapted marketing mix and choice architecture framework developed after reviewing the selected evidence. The investigators operationalized the definitions for eight voluntary marketing mix and nudge strategies across two intervention categories that included *place, profile, portion, pricing, promotion*, healthy default *picks, priming* or *prompting* and *proximity*.

The first intervention category in the combined marketing mix and nudge framework represents voluntary changes made to the *properties* of the restaurant environment and/or food, beverage or meal products served and sold in the restaurant environment including (1) place (ambience or atmospherics), (2) profile (nutrient composition), (3) portion, (4) pricing and (5) promotion (responsible food marketing). The second intervention category represents voluntary changes made to the *placement* of food, beverage or meal products served and sold in the restaurant environment including (6) healthy default picks, (7) priming or prompting (labelling and contextual information) and (8) proximity (positioning).

RQ2: recommendations issued by authoritative U.S. bodies for the restaurant sector

Table 4 provides a timeline and summary of 16 authoritative reports issued between 2006 and 2016 by expert interdisciplinary panels or committees, U.S. government task forces or cross-sectoral partnerships (63–76); and industry trade organizations or self-regulatory programs (77–79); for the U.S. restaurant sector to improve and expand healthy meals and products for customers. The recommendations are discussed according to each of the eight strategies in the adapted marketing mix and nudge framework discussed below.

Strategy #1: Place

Place represents changes made to the internal setting (i.e. lighting or visual cues) of a restaurant to influence customers' expectations about the ambience or atmospherics to highlight healthy food and beverage products (80) that support healthy dietary guidelines (81). It is also important for restaurant owners to create and ambience or atmosphere that reduces excessive stimuli that may influence customers to make impulsive decisions to purchase and consume energy-dense and nutrient-poor choices. Restaurants have many opportunities to influence ambience and atmospherics by using music, lighting, colour, decor and spatial layout to make healthy choices more appealing to young customers and their parents (82).

Ambience and atmospheric research with adults has demonstrated that those who listen to music while eating increased the amount of food and calories consumed (83), and classical music may lead to higher spending at restaurants compared with popular or no music (84). Additional research suggests that the use of bright lights in restaurants may help adult diners to select healthier options on menus (e.g. grilled or baked chicken, vegetables and white meat) instead of fried foods and desserts (85). The Culinary Institute of America and Harvard's Menus of Change (66) was the only body to recommend that restaurants create kitchens that support the environmentally friendly preparation of fresh and healthy foods and eating spaces that encourage consumers to make healthy and sustainable choices.

Voluntary Marketing Mix and Nudge Strategies to Promote Healthy Restaurants[1]

1 Place
Use lighting and visual clues to highlight healthy food and beverage choices

2 Profile
Use fresh and healthy ingredients to ensure that 50% or more of meals meet recommended nutrient targets[2]

Chicken Nuggets → BBQ Chicken Breast
Fried Fish → Salmon Filet
Hamburger → Veggie Burger
Mac & Cheese → Skinny Chicken Bake

3 Portion
Reduce and standardize meal portion sizes to meet recommended nutrient targets[2]

Kids 550 calories/meal
Teens 600 calories/meal
Adults 600 calories/meal

4 Pricing
Use pricing strategies to increase sales and revenue for healthy choices that meet recommended nutrient targets[2]

Healthy Menu
* Half portions are half price every day!

WRAPS $6/$3 (1/2 portion)
Asian Chicken
Vegetarian
Tuna Melt

PANINIS $8/$4 (1/2 portion)
Turkey Bacon Avocado
Spicy Chicken
Tuna Melt

SALADS $8/$4 (1/2 portion)
Kale Caesar
Asian Sesame
Mediterranean

5 Promotion
Use responsible marketing practices to promote healthy food and beverage products that meet recommended nutrient targets[2]

6 Picks
Establish *healthy default* choices for side dishes and beverages for all bundled meals sold to children, teens and parents

7 Priming or Prompting
Offer menu labeling and contextual info to help customers make healthy choices[3]

Hamburger $3.99 540 Calories 90 min
Large Fries $2.20 600 Calories 25 min
Kid's Meal $3.99 600 Calories 120 min
Large Soda $1.99 250 Calories 25 min
Bottled Water $1.19 ZERO Calories

8 Proximity
Place healthy choices at eye level and physically closer to customers at point-of-purchase

Order Here
Menu Today's Specials

QDesign

[1] Quick-service, fast-casual and full-service chain restaurants and non-chain restaurants.

[2] **Recommended nutrient targets: calories** (≤ 600 calories/meal for children and ≤ 700 calories/meal for teens and adults); **fat** (≤ 35% calories), **saturated fat** (≤ 10% calories), **added sugars** (≤ 35% calories) and **sodium** (≤ 210 mg–450 mg/meal item).

[3] **For children:** 1,200 to 1,400 calories a day is used for general nutrition advice for ages 4 to 8 years and 1,400 to 2,000 calories a day for ages 9 to 13 years, but calorie needs vary.
For adults: 2,000 calories a day is used for general nutrition advice, but calorie needs vary.
Upon customer's request, restaurants must provide written nutrition information for total calories, fat, saturated fat, *trans* fat, cholesterol, sodium, protein, carbohydrates, fiber, and added sugars.

Figure 2   Voluntary marketing mix and nudge strategies to promote healthy restaurants.

Table 3 Marketing mix and choice architecture framework organized by category, strategies and performance metrics to evaluate restaurant-sector progress to promote healthy food environments for children, adolescents and their parents

Category	Strategy	Performance metrics
Voluntary changes made to the properties of the restaurant environment and/or food, beverage and meal products served and sold in the restaurant environment to influence customers' purchasing and consumption behaviours	**1. Place** Change the internal setting (i.e. lighting or visual cues) to influence customers' expectations about the ambience or atmosphere to highlight food and beverage products that support healthy dietary guidelines.* *Dietary Guidelines for Americans 2015–2020 and other expert recommendations (i.e. USDA's Smart Snacks in School Standards, School Meal Standards, and Healthy Eating Research Healthy Beverage Guidelines.*	• Restaurant has used lighting or visual cues to create an ambience or atmosphere that highlights food and beverage products that support healthy dietary guidelines and a healthy food and eating environment.
	2. Profile Change the nutritional profile, quality, smell, taste, texture and flavour of food and beverage products that meet recommended nutrient targets to support healthy dietary guidelines.*	• Restaurant has reformulated or developed new products to improve the nutritional profile, quality, smell, taste, texture and flavour of food and beverage products that meet recommended nutrient targets to support healthy dietary guidelines. • Restaurant offers entrees, value and bundled meals with side dishes that meet recommended nutrient targets for energy (≤600 calories/meal for children and ≤700 calories/meal for teens and adults), fat (≤35% total calories), saturated fat (≤10% total calories), added sugars (≤35% total calories) and sodium (≤210 mg to 410 mg/meal item).
	3. Portion Reduce and/or standardize the portion size of food and beverage products that meet recommended nutrient targets to influence customers' expectations about single servings and appropriate portions to support healthy dietary guidelines.*	• Restaurant has reduced and/or standardized the portion size of food and beverage products that meet recommended nutrient targets for energy (≤600 calories/meal for children and ≤700 calories/meal for adolescents and adults), fat (≤35% calories/item), saturated fat (≤10% calories/item), sugar (≤35% calories/item) and sodium (≤210 milligrams to 450 milligrams/item).
	4. Pricing Use pricing strategies (i.e. proportionate pricing for smaller portions and limiting price promotions on large portions) to increase sales and revenue for products that meet recommended nutrient targets to support healthy dietary guidelines.*	• Restaurant has used pricing strategies to promote smaller portions that are competitively priced compared to energy-dense and nutrient-poor options sold in larger portions and package sizes. • Restaurant has tracked sales and revenue for smaller-portion products that meet recommended nutrient targets to support healthy dietary guidelines.
	5. Promotion Use responsible food and beverage marketing practices (i.e. colourful packaging for smaller portions; changing the name, appearance of food or beverage product, appeal and attractiveness of products) that meet recommended nutrient targets to support healthy dietary guidelines.*	• Restaurant has implemented and enforced a policy to use responsible food and beverage marketing practices to promote products that meet healthy dietary guidelines to children, adolescents and parents. • Restaurant has used menu design principles (i.e. graphics and placement) to emphasize fresh, seasonal and minimally processed food and beverage products for all customers. • Restaurant has implemented and enforced a policy to restrict the promotion of high fat, sugary and salty food and beverage products to young people through television advertising, toy premiums, licensed media characters, celebrity endorsement, mobile and digital marketing.

(*Continues*)

Table 3 (Continued)

Category	Strategy	Performance metrics
Voluntary changes made to the placement of food, beverage and meal products served and sold in the restaurant environment to influence customers' purchasing and consumption behaviours	**6. Healthy Default Picks** Use environmental cues that are convenient, accepted and expected to socially normalize healthy default choices for side dishes and beverages for children, adolescents and parents. **7. Priming** or **Prompting** Use information (e.g. menu labelling and contextual information) to help customers make healthy decisions at point-of-choice and point-of-purchase. **8. Proximity** Place healthy choices at eye level and physically closer to customers at point-of-choice and point-of-purchase.	• Restaurant has implemented and enforced a policy to offer healthy default side dishes (e.g. fruits and vegetables) with bundled meals; healthy beverages (e.g. low-fat or non-fat milk, 100% juice and water); and whole grains with all meals sold to children, adolescents and parents. • Restaurant has fully implemented and complied with the Food and Drug Administration's menu-labelling regulations prior to the mandatory start date in May 2017 to help inform customers' healthy choice purchases. • Restaurant has placed fruits, vegetables, salads and whole grains closer to customers' point-of-choice (i.e. buffet lines) and point-of-purchase (cash register) locations.

Table 4 Timeline of recommendations issued by authoritative bodies for the U.S. restaurant sector to promote healthy food environments to American children, adolescents and their parents, 2006–2016

Year	Authoritative body
2006	IOM released an expert committee report on Food Marketing to Children and Youth
2006	FDA and the Keystone Center released a report of the interdisciplinary Forum on Away-From-Home Foods
2008	FTC released the first monitoring report on industry marketing practices to children and adolescents
2010	White House Task Force on Childhood Obesity released a multi-federal agency report to reverse obesity rates
2010	National Salt Reduction Initiative released sodium targets for the packaged and restaurant industries
2010	U.S. Congress passed the National Restaurant Menu Labeling Law (Section 4205 of Public Law 111–148 [H.R. 3590])
2011	Federal Interagency Working Group on Foods Marketed to Children released draft guidelines for healthy food marketing to children
2011	National Restaurant Association and Healthy Dining launched the Kids LiveWell Program
2011	CBBB released the CFBAI's uniform nutrition criteria for members including restaurant companies
2012	IOM released an expert committee report on Accelerating Progress to Prevent Childhood Obesity
2012	FTC released a second monitoring report on industry marketing practices to children and adolescents
2013	NIH and RAND Corporation's expert panel released an expert report to establish restaurant standards
2013	Culinary Institute of America and President and Fellows of Harvard College released Menus of Change Principles for the restaurant sector
2015	RWJF's Healthy Eating Research expert panel released recommendations for responsible food marketing to children
2015	Dietary Guidelines Advisory Committee Report was released with specific recommendations for the restaurant sector
2016	FDA released the final labelling guidelines for chain restaurants selling away-from-home foods

Abbreviations: CBBB, Council of the Better Business Bureaus; CFBAI, Children's Food and Beverage Initiative; FDA, Food and Drug Administration; FTC, Federal Trade Commission; IOM, Institute of Medicine; NIH, National Institutes of Health; NRA, National Restaurant Association; RAND, Research and Development Corporation; RWJF, Robert Wood Johnson Foundation.
Note: The IOM was renamed the Health and Medicine Division (HMD) of the National Academies of Sciences, Engineering, and Medicine in 2016.

Strategy #2: Profile

Profile represents voluntary changes to the nutritional profile, quality, smell, taste, texture and flavour of food and beverage products that meet recommended nutrient targets (32) that support healthy dietary guidelines. Nine of 16 authoritative bodies (65–68,70,72,73,77) recommended that restaurants improve the nutritional profile of meals sold without sacrificing taste by setting calorie limits for adults and adolescents (≤700 calories/meal) and children (≤600 calories/meal) and meeting recommended targets for sodium, total fat, saturated fat, *trans* fat and added sugars. Additionally, the Culinary Institute of America and

Harvard's Menus of Change also offered principles to guide menu design by emphasizing fresh, seasonal, sustainably grown and minimally processed foods; and food and ingredient selection by choosing healthier oils, reducing the frequency of serving meat and reducing added sugars and sodium (66).

Strategy #3: Portion

Portion involves restaurants reducing and/or standardizing the portion size of food and beverage products to meet recommended nutrient targets to influence customers' expectations about appropriate portion sizes for a single serving to support healthy dietary guidelines and reduce

their risk of obesity and diet-related NCDs (31,32,36). Six of the 16 authoritative bodies (64,66–68,73,74) recommended that restaurants reduce the portion size of meals, beverages, side dishes and desserts; and expand innovative packaging to help consumers to reduce calories and meet nutrient targets.

Strategy #4: Pricing

Pricing involves restaurants using such strategies as proportionate pricing for smaller portions and limiting price promotions on large or supersized portions to increase sales and revenue for products (36,80) that meet recommended nutrient targets to support healthy dietary guidelines. Three of the 16 authoritative bodies (65,68,73) recommended that restaurants use pricing strategies to expand affordable and competitively priced options; refrain from charging customers extra for requesting half portions or smaller-sized meals; and explore how pricing can be used with existing distribution systems to bring fresh and healthy foods to underserved communities.

Strategy #5: Promotion

Promotion involves restaurants adhering to responsible food and beverage marketing practices that promote products that meet recommended nutrient targets to support healthy dietary guidelines. Examples of practices include restaurant owners using colourful packaging for smaller portions; and changing the name, appearance, appeal and attractiveness of products. Thirteen of the 16 authoritative bodies (63–68,70,71,73,74,76,77,79) recommended that restaurants use their full creativity and resources to shift their marketing practices to promote healthy profile products and to follow specific nutritional guidelines to restrict the marketing of HFSS products. It was also recommended that restaurants engage in responsible food and beverage marketing across all venues and media platforms including television advertising, toy premiums, licensed media characters, celebrity endorsement and mobile and digital marketing.

Strategy #6: Healthy Default Picks

Healthy default picks are automatic choices that restaurant owners can use to socially normalize healthy options including side dishes and healthy beverages for customers to help meet dietary targets. Bundling is another healthy default strategy by selling a higher proportion of 'bundled' meals with healthy sides and reducing the proportion of meals with energy-dense side dishes or high-calorie beverages (86). Yet another healthy default strategy is for restaurants to replace a policy of unlimited free refills for full-calorie beverages with a policy that promotes water or zero-calorie beverages at fountains.

Healthy default picks become convenient, accepted and expected by children, adolescents and parents

(32–34,36,61). Four authoritative bodies (65,68,73,74) recommended that restaurants establish healthy default options for side dishes to children's meals by replacing fries with fruits (e.g. strawberries or apple dippers) or vegetables (e.g. celery or baby carrots); replacing sugar-sweetened beverages with low-fat or non-fat milk, 100% juice or water; and replacing refined grains (i.e. white rice or white bread) with whole grains (i.e. brown rice, quinoa, couscous or whole wheat bread).

Strategy #7: Priming or Prompting

Priming or prompting involve restaurant owners using information such as menu labelling, symbols, icons, motivational messages and/or contextual information to help customers to select healthy products at point-of-choice (i.e. ordering at counters or on menus) and point-of-purchase (i.e. pre-payment at the cash register) (31–33). Ten of 16 authoritative bodies (63–67,73–77) recommended that chain restaurants with 20 or more U.S. locations provide customers with prominent and visible labelling for calories and other nutrition information for products listed on menus and packaging that align with the FDA's menu-labelling guidelines. Companies should also partner with researchers to evaluate the effectiveness of various labelling schemes to convey meaningful and truthful information (36); use menu design strategically to prompt the healthiest choices (32); train employees to prompt customers to choose healthy options (73); and inform customers about how the foods served were produced by providing consumer-friendly information about environmentally sustainable practices, human labour and animal welfare (66,74).

Strategy #8: Proximity

Proximity involves restaurants placing healthy choices at eye level and physically closer to customers to make them more visible and easy to select. One example is for restaurant owners to place fruits, salads and whole grains physically closer to customers' point-of-choice on restaurant buffet lines (80). Research on the proximity of food choices has shown a 'first-foods most' phenomenon among adult diners who select more options at the beginning of a self-serve restaurant buffet line (80). Only one of the 16 authoritative bodies recommended that restaurants should place healthier items physically closer to customers at eye level for foods on display (73).

RQ3: performance metrics to evaluate U.S. restaurant sector progress

Based on the collective recommendations issued by 16 authoritative U.S. bodies for the restaurant sector (Table S1), we developed 12 performance metrics for the

eight strategies in the new marketing mix and nudge framework (Table 3 and Fig. 2).

Discussion

Chain and non-chain restaurants in the U.S. and other countries must transform their business models to encourage all customers to choose and consume healthy food and beverage options to promote healthy food environments and prevent obesity and NCDs. To achieve this goal, it is necessary for restaurant owners to align business practices with the recommendations of several expert bodies that include the USDA and Health and Human Services' 2015–2020 Dietary Guidelines for Americans (81), the World Health Organization's recommendations to reduce childhood obesity (87), the World Health Organization Action Plan to reduce premature mortality from NCDs by 25% by 2025 (88) and the United Nations Sustainable Development goal to reduce premature mortality from NCDs by one third and ensure healthy lives for all by 2030 (89).

The use of choice architecture or nudge strategies to cue healthy behaviours in micro-environments are believed to be effective based on three assumptions that people will (1) choose options that require the least amount of mental or physical effort; (2) align their behaviour with prevailing social norms; and (3) identify with peer groups that reinforce specific lifestyle behaviours (47). The results from this review underscore two insights about these assumptions. First, to combine many strategies within a single setting where people make dietary decisions to influence their health. Second, to evaluate the effectiveness of the synergistic changes based on how restaurant customers' behaviour corresponds to these assumptions.

In *The Art of Choosing*, Sheena Iyengar emphasizes other fundamental assumptions about choice that deserve consideration when designing choice architecture interventions (90) that are not addressed in this review. For example, American culture has a deeply embedded value of making one's own choice (compared with other cultures). Americans expect and respond favorably to personal autonomy that has been used in promotional taglines of chain restaurants such as Burger King's '*Have it your way*' and Starbuck's '*Happiness is in your choices*' (90).

A recent review of interventions to promote healthy ready-to-eat meals sold at chain restaurants and other food outlets found that the most effective strategies used incentives or disincentives to guide choices or to restrict choices instead of only providing information to enable healthy choices (91). There are substantial limitations if restaurant owners voluntarily use choice architecture interventions (i.e. *portion*, healthy default *picks*, *priming* or *prompting* and *proximity*) in isolation of marketing mix interventions (i.e. *product* [making changes to the nutrient composition of food and beverage products]; *place* [using diverse marketing and media channels]; *price* [using proportionate pricing strategies to promote the healthiest products]; and *promotion* [using responsible marketing practices using integrated marketing communications, especially when targeting children and adolescents]). All of these strategies can be combined and used to evaluate the U.S. restaurant sector progress toward creating healthy food environments with an emphasis on reaching children, adolescents and their parents.

Strengths and limitations

The primary strength of this three-step review is that it addressed a broad and complex policy-relevant topic and synthesized relevant evidence in a narrative review to inform both private and public sector policies to enable the restaurant sector to promote healthy food environments for customers. This systematic evidence review led to the development of a novel marketing mix and nudge framework that combines eight strategies. When implemented collectively by U.S. chain and non-chain restaurant owners, this framework could potentially facilitate a tipping point, where small changes significantly encourage healthy eating behaviours, to help reduce obesity and diet-related NCD rates through industry-wide adoption of these strategies. This framework can also be used by government agencies and civil society organizations to monitor and evaluate restaurant-sector progress (92) to hold large chain restaurants accountable for using a comprehensive approach to encourage and socially normalize healthy food environments for customers (37).

One limitation of this study is that some strategies may not be entirely relevant for certain restaurant sub-sectors, such as proximity for QSRs or FCRs, which may be more relevant for FSRs where buffets are available for customers to select their own food items. A second limitation is that the marketing mix and nudge framework is a proof of concept that needs to be tested empirically for feasibility in a real-life setting to assess whether the performance metrics are realistic and meaningful for each of the eight strategies. A third limitation is that we may have overlooked other choice architecture frameworks that were not published in the peer-reviewed literature. Finally, certain issues were beyond the scope of this study that have been addressed elsewhere including the ethics of government using nudge interventions, the unintended consequences of nudging, cultural differences in accepting different types of nudge and marketing interventions, and whether enhancing the transparency of nudge interventions to the public may influence their effectiveness (61,93–95).

Future research could operationalize and test this framework in the U.S. and compare the results with other countries, especially low-income and middle-income countries, where U.S. restaurants operate franchise businesses. There is also a need to examine how different research designs that use marketing mix and nudge interventions can adopt standardized outcomes that can be compared across different types and combinations of interventions to determine their effectiveness for various settings (95–97).

Conclusion

There is compelling evidence that HFSS food and beverage products frequently purchased at chain and non-chain restaurants increase the risk of developing obesity and diet-related NCDs. National governments have been reluctant to use legislative and regulatory solutions to compel the restaurant sector to promote healthy default options and to mandate an improved nutritional profile of foods and beverages sold. Nevertheless, restaurant owners have many opportunities to use comprehensive marketing mix and choice architecture strategies to promote healthy food and beverage choices and healthy food environments to customers.

Government agencies have a role to coordinate public policies, legislative and regulatory actions, and civil society organizations can monitor and evaluate the impact of comprehensive voluntary restaurant interventions to hold restaurants accountable for promoting healthy food environments. This policy-relevant marketing mix and nudge framework is a proof of concept that restaurant owners should test for feasibility in a real-life setting to assess whether the performance metrics are realistic and meaningful for each of the eight strategies. This novel framework has potential to promote and socially normalize healthy food environments to reduce obesity and NCDs among populations in the U.S. and other countries.

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Conflict of interest statement

Author contributions

V. I. K. developed the initial concept, designed the literature review search strategy, led and conducted the evidence collection and analysis, prepared the first draft of the manuscript, coordinated feedback for subsequent revisions and oversaw the submission process. T. E. assisted with the literature search and completed the evidence tables, and along with S. M. and E. L. S., contributed to the independent evidence review and analysis, provided input into the design and data collection, developed further the concepts explored in the paper and provided feedback on subsequent drafts of the manuscript. All authors approved the final manuscript.

Supporting information

Additional Supporting Information may be found online in the supporting information tab for this article. https://doi.org/10.1111/obr.12553

Table S1. Recommendations issued by authoritative bodies for the U.S. restaurant sector to promote healthy food environments for American children, adolescents and their parents, 2006–2016.
Figure S1 Typology of choice-architecture interventions
Figure S2 Taxonomy of choice-architecture techniques
Figure S3 Conceptual model of a multi-frame approach to improve dietary interventions
Figure S4 Behavioral Insights Team MINDSPACE framework for behaviour change (2010)
Figure S5 Framework to assess attributed responsibility and manipulation to assign functions of interventions into one of four classes

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