HHS Public Access

Author manuscript

Curr Atheroscler Rep. Author manuscript; available in PMC 2019 April 14.

Published in final edited form as:

Curr Atheroscler Rep. ; 20(5): 25. doi:10.1007/s11883-018-0726-x.

Adoption and Design of Emerging Dietary Policies to Improve Cardiometabolic Health in the US

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Abstract

Purpose of Review.—Suboptimal diet is a leading cause of cardiometabolic disease and economic burdens. Evidence-based dietary policies within 5 domains – food prices, reformulation, marketing, labeling, and government food assistance programs – appear promising at improving cardiometabolic health. Yet, the extent of new dietary policy adoption in the US and key elements crucial to define in designing such policies are not well established. We created an inventory of recent US dietary policy cases aiming to improve cardiometabolic health and assessed the extent

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Author Contributions

Ms. Huang and Dr. Micha had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Huang, Mozaffarian, Micha.

Acquisition, analysis, or interpretation of data: all authors.

Drafting of the manuscript: Huang, Micha.

Critical revision of the manuscript for important intellectual content: All authors.

Obtained funding: Micha.

Administrative, technical, or material support: Huang.

Study supervision: Micha.

Conflict of Interest

Ms. Huang, Drs. Pomeranz, Wilde, Capewell, Gaziano, Kersh, O'Flaherty, Mozaffarian, and Micha report grants from NIH during the conduct of the study. Dr. Whitsel serves as the Director of Policy Research for the American Heart Association. In addition, Dr. Micha reports personal fees from the World Bank, Bunge, and Dr. Mozaffarian from Astra Zeneca, Acasti Pharma, GOED, DSM, Haas Avocado Board, Nutrition Impact, Pollock Communications, Boston Heart Diagnostics, Bunge, and UpToDate, outside the submitted work.

Compliance with Ethics Guidelines

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

of their proposal and adoption at federal, state, local and tribal levels; and categorized and characterized the key elements in their policy design.

Recent Findings.—Recent federal dietary policies adopted to improve cardiometabolic health include reformulation (*trans*-fat elimination), marketing (mass-media campaigns to increase fruits and vegetables), labeling (Nutrition Facts Panel updates, menu calorie labeling), and food assistance programs (financial incentives for fruits and vegetables in the Supplemental Nutrition Assistance Program (SNAP) and Women, Infant and Children (WIC) program). Federal voluntary guidelines have been proposed for sodium reformulation and food marketing to children. Recent state proposals included sugar-sweetened beverage (SSB) taxes, marketing restrictions, and SNAP restrictions, but few were enacted. Local efforts varied significantly, with certain localities consistently leading in the proposal or adoption of relevant policies. Across all jurisdictions, most commonly selected dietary targets included fruits and vegetables, SSBs, *trans*-fat, added sugar, sodium and calories; other healthy (e.g., nuts) or unhealthy (e.g., processed meats) factors were largely not addressed. Key policy elements to define in designing these policies included those common across domains (e.g. level of government, target population, dietary target, dietary definition, implementation mechanism), and domain-specific (e.g., media channels for food marketing domain) or policy-specific (e.g. earmarking for taxes) elements. Characteristics of certain elements were similarly defined (e.g., fruit and vegetable definition, warning language used in SSB warning labels), while others varied across cases within a policy (e.g., tax base for SSB taxes). Several key elements were not always sufficiently characterized in government documents, and dietary target selections and definitions did not consistently align with the evidence-base.

Summary.—These findings highlight recent action on dietary policies to improve cardiometabolic health in the US; and key elements necessary to design such policies.

Keywords

diet; nutrition; policy; tax; subsidy; labeling

INTRODUCTION

Suboptimal diet is a leading cause of disease burden in the US, contributing to almost half of all annual deaths due to cardiometabolic diseases including coronary heart disease, stroke, and type 2 diabetes [1]. Among diet-related illness, the direct and indirect costs of cardiometabolic diseases alone exceed $500 billion per year and are expected to exceed $1 trillion by 2030 [2, 3]. Considering substantial diet-related burdens and escalating healthcare costs, effective approaches to address poor diet are urgently needed.

While individual-based approaches can be effective at promoting behavior change, such interventions are often costly, difficult to sustain, and reach only portions of the population, potentially even worsening disparities [4–6]. Our group and others have identified promising population-based (policy) dietary strategies that could reach larger segments of society; have broader, less costly and more sustained impact; and reduce disparities [7–13]. Yet, the extent that the current US food policy landscape reflects evidence-based solutions is unclear [14], or whether federal, state and local actions have a coherent agenda. While policies and programs were created over decades to address hunger and food insecurity, advances in

dietary policies to improve cardiometabolic health are less established. A review of recently adopted or proposed policy efforts can inform current priority areas and contribute to the development of a national food strategy to reduce diet-related chronic diseases.

Furthermore, little is known about the key elements that are defined when designing specific dietary policies, elements that could alter the effectiveness, feasibility, costs, reach or sustainability of a given policy. For instance, while prior research has demonstrated the effectiveness of a healthy food subsidy, there is no guiding framework or taxonomy to characterize different subsidy schemes, which products to subsidize, who these subsidies should reach, and how they can be delivered. These elements and their potential characteristics may also differ or overlap across policy domains. As policymakers consider a variety of dietary policies to improve cardiometabolic health, categorizing and defining key elements in policy design are especially relevant and timely.

To address these questions, we reviewed the extent of new dietary policy proposal and adoption for evidence-based strategies to improve cardiometabolic health across multiple levels of government in the US (federal, state, local, tribal). In addition, we reviewed the categorization and definitions of key elements in these policies. This investigation was performed as part of the Food-PRICE (Policy Review and Intervention Cost-Effectiveness) Project.

METHODS

Selection of Evidence-Based Dietary Policies to Improve Cardiometabolic Health

The evidence for effectiveness of specific population-level dietary policies to improve cardiometabolic health has been reviewed by our group and others [7–13]. Based on this prior work, we identified 11 dietary policies with a strong evidence-base and relevant to current US food policy discussions [7–9, 15–22] (Table 1). These policies were organized in 5 domains: (1) food prices, such as fiscal measures to discourage (tax) consumption of sugar-sweetened beverages (SSBs) and unhealthy/”junk” food, or to incentivize (subsidy) consumption of healthy food; (2) food reformulation, policies to improve the nutrient profile of food products by altering specific nutrients, such as *trans*-fat and sodium; (3) food marketing, such as mass-media campaigns for or against specific products, or marketing restrictions to children; (4) food labeling, such as nutrition labels to support informed consumer choice (front-of-pack label, Nutrition Facts Panel, menu calorie labeling) or warn about health harms; and (5) improvements to government food assistance programs, such as introduction of financial incentives for healthy food purchases or restrictions for unhealthy food purchases in the Supplemental Nutrition Assistance Program (SNAP).

This review focuses on new and emerging dietary policies to improve cardiometabolic health. Thus, we did not review more established programs such as the Dietary Guidelines for Americans [23], the National School Lunch Program [24], or Meals on Wheels [25]; or other policies focused on nutrient deficiencies (e.g., salt iodization, folic acid fortification), other health and safety issues (e.g., water sanitation, additives, coloring), general lifestyle (e.g., physical activity, obesity, alcohol, smoking), and policies not having a direct focus on nutrition (e.g., agricultural subsidies, environmental or trade policies). We also excluded

organizational food environment initiatives (e.g., nutrition standards in the workplace) and built environment strategies (e.g., proximity to food store locations), as such policies continue to have more limited evidence for efficacy to improve cardiometabolic health [26–28]. We did not include school, afterschool, and early childcare food policies in the present review (e.g., nutrition standards in the National School Lunch and School Breakfast Program, the Child and Adult Care Food Program, the Fresh Fruit and Vegetable Program, Smart Snacks regulation), as these policies have been extensively documented elsewhere [29–37].

Search Strategy for Recent US Dietary Policy Cases

For each of 11 identified dietary policies, we performed searches of government, academia, policy and advocacy organization websites and online databases for newly proposed or adopted -mainly from 2010 onwards- US policy cases at federal, state, local and tribal (i.e., Native American tribe) levels (Resource 1). Policy cases were broadly defined to include proposed bills, laws (including rules/regulations), programs, voluntary guidelines, and resolutions or formal requests from a state or local government to the federal government to change policy. Each policy case was separately catalogued (e.g., companion bills were each recorded as their own policy case). Programs and guidelines led by the industry or non-governmental organizations were excluded. If US federal laws for a given policy had been passed that preempted or otherwise rendered state/local laws irrelevant, we did not search further for state and local cases. For SSB taxes, given 34 states already tax SSBs as part of their general sales tax and 7 states have excise tax on SSBs for revenue purpose (the majority of which were enacted before 2010) [38], we did not include these existing taxes in our results or search for bills amending or reenacting these taxes. For “junk” food taxes, we did not include broad taxes on food in 12 states (which would additionally include “junk” food) given these taxes do not specifically target unhealthy food [39]. Searches were supplemented with expert contacts with academic researchers, public health experts, and nutrition policy advocates. For each policy case, one author (YH) recorded in a standardized electronic spreadsheet, the corresponding dietary policy and domain, policy case type (bill, law, program, guideline, resolution) and name, level of government (federal, state, local, tribal), location, legislative status (enacted, proposed, implemented), and year enacted, proposed, or implemented.

Key Elements of US Dietary Policy Design

To categorize and describe key elements in the design of each policy, we performed four steps. First, two authors (YH, RM) reviewed the policy description for each identified policy case from texts of bills, laws, government programmatic reports, and guideline documents. Second, we identified common patterns in the design of each policy. Third, emerging patterns that could have health implications were identified as elements (categories) in the design; rather than focusing on other legislative details such as the number of legislative sponsors, the policy’s implementation date, and so on. The final selected policy elements were based on discussion and consensus with all co-authors and additional input from expert consultations. Fourth, we extracted information on each element for each dietary policy according to a standard set of characteristics in an electronic spreadsheet. These characteristics were informed by the policy case text and supplemented by peer-reviewed

literature, government-commissioned reports on related policies, and recommendations from advocacy organizations. We did not categorize and describe key elements for strategies where major federal laws preempted or otherwise rendered state/local laws irrelevant, as details in the policy design have been defined by the relevant implementing agencies.

RESULTS

Food Prices – SSB Taxes

We identified 135 cases of proposed or adopted SSB taxes in the US, including 8 local laws, 5 local bills, 1 tribal law (Navajo Nation), 119 state bills (mostly imposing new taxes, and less so eliminating tax exemption), and 2 federal bills (Table 2, Resource 2, Resource 3). At the federal level, only the Sweet Act (proposed twice in two legislative sessions) was identified [40, 41] and it did not pass.

Based on these observed policy cases, supplemented with other literature [38, 42–44], we categorized and characterized nine key elements in the design of SSB tax policy. These included the level of government (i.e., federal, state, local), target population (i.e., whole population), dietary target, dietary target definition, type of tax, tax base, tax rate, implementation mechanism, and presence and type of earmarking (Table 3). For example, SSBs were most commonly defined by product category (e.g., soda, energy drink) and calorie (or sugar content) cut points; however, the precise dietary target naming (e.g., SSBs, sweetened beverages, soft drinks, and sugary drinks) and definition varied by policy case. Taxed beverages typically included soda, sports drinks, energy drinks, fruit drinks, and presweetened tea and coffee; in a few cases, artificially sweetened beverages were included. Some policy cases additionally taxed syrups and powders used in soda fountains to make SSBs. Type of taxes included sales (N=18), excise (N=104), and gross-receipts (N=4) taxes; 9 proposed state bills did not specify the type of tax. The tax base (the measure upon which the tax rate is calculated) varied and included sale price, beverage volume, syrup volume, sugar content, container deposit and SSB sellers' gross revenue. Types of tax rates were further either a flat rate or tiered rate. The implementation mechanism depended on the type of tax. Lastly, while nearly half of the tax cases were proposed for health purposes, some directed the revenue to the general treasury while others earmarked it for specific purpose, including public health programs (e.g., child obesity prevention, health research). Earmarking was only observed for excise and gross-receipts taxes, as sales tax revenue is generally deposited into the general treasury.

Food Prices – "Junk" Food Taxes

For unhealthy or "junk" food taxes, we identified 24 recent policy cases, including 1 tribal law (Navajo Nation), 2 state laws (Maine, whose sales taxes include "non-staple grocery items" and Texas, whose sales tax includes individual-sized snack foods), and 21 proposed state bills (Table 2, Resource 3). Eight of these state bills proposed new/additional taxes, and 12 proposed eliminating current tax exemptions (thus making a product taxable). One bill proposed to change the definition of food qualifying for a deduction from gross receipts tax. No recent local or federal bill or law was found. Among the 9 identified key policy elements, many were similar to the SSB taxes, yet notable differences were also seen (Table 3). For

instance, there was greater variability in which dietary targets were selected and how these were defined. Dietary targets were all unhealthy foods (foods referring collectively to foods and beverages), but the naming included snacks, non-staple grocery items, non-foods (vs foods that are exempt), junk food, and minimal-to-no-nutritional value foods. Taxed foods were defined based on a product/category approach (e.g., SSBs, candy, chips, pretzels, desserts, frozen desserts, baked goods, cereals/granola bars, processed meat products), a nutrient-based approach (e.g., sugar, sodium, saturated fat), or a combination of product + nutrient approach [45]. The type of taxes identified included sales (N=16), excise (N=3), and gross-receipts (N=2) taxes; 3 bills did not specify the type. The Navajo Nation and 6 the state bills were earmarked for health purposes.

Food Prices – Healthy Food Subsidies

We identified 14 recent policy cases on healthy food subsides, including 1 tribal law (Navajo Nation) and 13 proposed state bills (Resource 3), and no recent local or federal efforts. Food subsidies within government food assistance programs were considered separately below. Four bills in New York state proposed a voluntary, senior benefits card program that would allow participants to purchase healthy foods at a discounted price at restaurants and markets. A Kentucky bill aimed to create a healthy food subsidy pilot program. Navajo Nation's law and 8 bills from 2 states (Mississippi, Tennessee) proposed tax exemption for foods deemed healthy according to the bill's definition. Both states are among the minority of US states that do not currently exempt food from sales tax [39].

Eight policy elements emerged, including level of government, target population, dietary target, dietary target definition, type of subsidy, subsidy scheme, subsidy rate, and implementation mechanism (Table 3). Seniors were targeted in the 4 New York bills, and tax exemption in the Navajo Nation law and in 8 proposed bills would apply to the whole population. Kentucky's pilot targeted "selected needy population dealing with the most serious health challenges" without further specification [46]. The New York bills targeted "healthy, appropriate foods" without specification. Fruits and vegetables were targeted in all tax exemption bills. The Navajo Nation tax exemption further applied to water, seeds, nuts and nut butters, and 4 bills proposing the tax exemption on "staple foods" or "unprepared foods" further included raw animal products (e.g., eggs, meat, poultry, fish, milk), whole grains, beans and legumes, nuts, bread and baking ingredients. Subsidy schemes included tax exemption and price discounts, which dictated the policy's implementation mechanism. Subsidy rate was not specified in the New York and Kentucky bills.

Food Reformulation - Trans-fat

The Food and Drug Administration (FDA) enacted regulation in 2003 that required mandatory disclosure of *trans*-fat content on the Nutrition Facts Panel (NFP) [47], which led to wide industry reformulation [48]. Numerous states and localities subsequently attempted and some succeeded in banning the use of artificial *trans*-fat in restaurants, bakeries, and/or schools [49]. In 2015, FDA announced that partially hydrogenated oils (PHOs, the primary source of artificial *trans*-fat in the American diet) are no longer "generally recognized as safe (GRAS)," and manufacturers are expected to remove PHOs from their products by 2018

[50]. We did not categorize and describe key elements in this policy as details in the design have been defined by the FDA.

Food Reformulation - Sodium

We identified the National Sodium Reduction Initiative (led by New York City, NYC) and 1 set of federal sodium reformulation guidelines (Table 2). Both NYC and the federal government (FDA) proposed voluntary reformulation targets on a broad range of processed and commercially prepared foods. These cases as well as other literature on sodium reformulation [51, 52] informed the selection of 6 policy elements: level of government, target population (i.e., whole population), target products, reduction goals, regulatory approach, and industry engagement. Sodium reformulation typically involved identifying products that contributed substantially to sodium in the diet; followed by setting product-specific reformulation targets within a realistic timeframe, accounting for technical barriers and potential safety issues around sodium reduction. The NYC-led program employed some strategies to encourage industry participation (e.g., rigorous monitoring and evaluation, positive publicity for companies that made public pledges to comply), but other methods exist, such as incentives (e.g., tax credits, research and development support) and/or disincentives (e.g., threatening of legislation, public reporting on noncompliance, updating the Daily Value for sodium, modification of GRAS designation for sodium) [51, 52].

Food Marketing - Mass-Media Campaigns for Healthy Foods

Numerous mass-media campaigns have been recently implemented in the US to promote healthy foods, including 5 local, 11 state, and 2 federal campaigns (Table 3). The federal campaigns identified included “Fruits and Veggies More Matters” (formerly 5-a-Day) [53], and the “Let’s Move!” child obesity campaign with a strong “eat healthy” component [54]. These campaigns informed the selection of 6 policy elements: level of government, target population, dietary target, dietary target definition, messaging, and media channel. Some campaigns, such as Fruits and Veggies More Matters, targeted the whole population, whiles others focused on specific populations (e.g., SNAP participants, parents, caretakers, children and adolescents). The campaigns’ target population dictated the selection of dietary targets, messaging and, media channels. Fruits and vegetables were the most common dietary targets in all campaigns, but some campaigns also promoted other foods recommended by the US Dietary Guidelines, such as low-fat milk for children. Dietary targets were most defined using a product/categorybased definition. Messaging varied from educating the target population about the health benefits of healthy food consumption, actionable dietary change (e.g., eat 5 fruits and vegetables per day, pack fruit as an alternative to unhealthy snacks), to encouraging parents to lead by example (e.g., “they learn from watching you”). A variety of media channels were identified, including traditional media (e.g., television, radio, print media) and new media (e.g., online advertisements, social media, online video channels, email), outdoor advertising (e.g., billboards or posters in school, community, workplace or healthcare settings), product packaging, advergames, sponsorships through sporting events, mobile devices through text messages, applications, and branded games. Of note, healthy food mass-media campaigns were often implemented as part of a larger public health initiative with other activities (e.g., community involvement activities) and messaging (e.g., to increase physical activity or prevent obesity).

Food Marketing - Mass-Media Campaigns for Unhealthy Foods

Fewer campaigns to discourage consumption of unhealthy food were identified: 7 at the local and 1 at the state level (Table 2). Key elements and characteristics were similar to healthy food mass-media campaigns, but unhealthy food campaigns mainly focused on reducing SSB consumption.

Food Marketing - Marketing Restrictions to Children

Two local laws, 1 local bill, 2 state laws, 22 state bills, 1 federal law, 7 federal bills, and 1 set of federal voluntary guidelines on food marketing to children were identified (Table 2, Resource 3, Resource 4). Seven key policy elements emerged, including level of government, target population, form of restriction, setting, dietary target, dietary target definition, and regulatory approach. Restriction took the form of regulating advertising (e.g., setting nutrition standards that marketed foods have to meet, or restricting marketing of unhealthy foods); regulating specific marketing techniques (e.g., use of toys with restaurant children's meals); or eliminating tax deductions for unhealthy food advertising to children. Setting was related to the form of restriction and was broadly characterized as the media channels or physical settings for implementing the restriction. For example, Maine has banned marketing of unhealthy foods on public school grounds [55]. In 2016, the USDA finalized regulation for all districts participating in the National School Lunch or Breakfast Program to prohibit marketing of foods that failed to meet USDA Smart Snacks standards by July, 2017 [56]. California recently enacted a law implementing this requirement [57]. Two local ordinances in San Francisco [58] and Santa Clara [59] prohibited restaurants from giving away free toys with children's meals unless certain nutrition standards were met. Twelve state bills identified proposed similar forms of restriction, and 11 focused on mandatory restriction of unhealthy food marketing in or near schools. Federal bills largely focused on eliminating tax deductions for unhealthy food marketing to children. The Interagency Working Group (IWG) proposed a set of voluntary principles to guide industry food marketing, such as increasing marketing for foods that contain a minimum amount of healthy ingredients (e.g., fruits, vegetables, whole grains, nuts/seeds, beans, lowfat dairy, fish, lean protein) and restricting marketing of unhealthy foods most heavily marketed to children (e.g., breakfast cereals, restaurant foods, snack foods) defined by nutrition standards [60]. IWG defined relevant marketing venues broadly, including but not limited to traditional media, Internet and other digital advertising, packaging and point-of-purchase display, product placement, contests and sweepstakes, cross promotion (e.g., character licensing), event sponsorship, word-of-mouth marketing, celebrity endorsements [60]. All policy cases targeted children, but the target age varied; most policy cases targeted children aged 14 years and under.

Food Labeling - Front-of-Pack Label (FOP)

For FOP, we identified 4 federal bills (Table 3), which only included language dictating general principles for the label design (e.g., label should use a simple and prominent symbol design, appear on all packaged products, be consistent with recommendations from the Dietary Guidelines, and easy for consumers to interpret). Since the federal government preempts most state and local food labeling laws, no other level of government proposed

similar policies. Using these bills and prior literature on FOP labels [61–63], we identified 8 key elements, including level of government (i.e., federal), target population (i.e., whole population), FOP location, type of FOP, FOP design symbol, dietary target, dietary target definition, and regulatory approach. The FOP label could be located on products packages or shelf tags. The type and design symbol of FOP included evaluative summary indicators (e.g., words, scores or icons that assess the nutritional quality of the product, such as a 0–3 star rating or color-coded traffic light); nutrient-specific summary indicators (e.g., words, scores or icons that describe the key nutrient quality, such as “high in fiber” or “warning: high in calories”); nutrient-specific data (i.e., value declaration of nutrient content); or a combination of these types [61]. Literature further suggested that FOP could target negative attributes of a product (e.g., calories, saturated fat, *trans*-fat, sodium, and added sugar) and/or positive attributes such as fruit and vegetable content, vitamins and minerals, dietary fiber, and protein [61]. The 4 federal bills identified all proposed a mandatory FOP label; however, of note, numerous voluntary FOP labeling schemes designed by the food industry, non-industry experts, and nongovernmental organizations exist in the US.

Food Labeling - Nutrition Facts Panel (NFP) and Menu Calorie Label

The Nutrition Labeling and Education Act of 1990 required NFP disclosure on food regulated by the FDA (Table 2), and preempts state and local disclosure requirements. In May 2016, FDA announced major revisions to NFP including changes to serving sizes, Daily Values, nutrients that are required or permitted to be labeled, and most notably a mandate to declare added sugar content and percent daily value [19]. In 2010, the federal government passed a national menu labeling law which required restaurants and similar food retail establishments with 20 or more locations to disclose the caloric content of any standard item on menu boards, and provide additional nutrient information (fats, cholesterol, protein, carbohydrates, sugars, fiber, sodium) upon consumer request (Table 2). This federal law preempts state and local labeling laws that apply to the same restaurants and are not identical to federal law [18]. Despite being hailed as major public health victories by advocacy groups, implementation on both policies continues to be delayed [64, 65]. Policy elements for these two policies were not categorized as the FDA has published detailed regulation documents.

Food Labeling - Health Warning Labels

We identified 2 local laws (NYC and San Francisco), 1 local bill, and 9 state bills requiring warning labels on food (Resource 2 and Resource 3). Key policy elements included level of government, dietary target, dietary definition, warning language, label location, and label design. The NYC law required chain restaurants to post warning icons next to menu items containing more than 2,300 milligrams of sodium with an accompanying warning statement indicating the cardiovascular risks associated with high sodium intake. The San Francisco law passed in 2015 would require a warning label on SSB advertisements, but it was recently blocked from implementation by the 9th Circuit Court of Appeals on grounds that the law likely violated the First Amendment rights of SSB advertisers [66]. Similar to the San Francisco law, all other bills targeted SSBs, with the naming (e.g., SSBs, beverages with added sugar, high-calorie beverages, sugary drinks) and definition varying modestly. Relatively similar language was used to indicate health risks associated with SSB

consumption such as obesity, diabetes, heart disease and tooth decay, with some bills calling the label a “safety warning.” Warning labels were proposed to be placed on advertisements, menus, sealed SSB containers, and/or the exterior of vending machines or self-serving dispensing machines for unsealed beverages. Other label design details identified include font type, font size, border thickness, and requirement of color-contrasting background.

Improvements to Government Food Assistance Programs - Financial Incentives for Healthy Food

Seven local programs, 3 state programs, 24 state bills, 5 federal programs, and 3 federal bills were identified that promoted use of financial incentives for healthy food in government food assistance programs (Table 2, Resource 3). The federal Farmers’ Market Nutrition Program for participants of the Women, Infants and Children (WIC) program and for seniors have been implemented since 1992 and 2007 respectively, and offer monthly checks/coupons for fruit and vegetable purchases [67, 68]. Eleven of the state bills identified were appropriation bills for these two programs. The local programs identified (e.g., NYC, Philadelphia, Boston) were among the first to subsidize fruit and vegetable purchases among SNAP participants mainly in farmers’ markets. Thirteen state bills we identified proposed pilot projects or funding for similar programs. The 2008 Farm Bill funded the Healthy Incentives Pilot (HIP) to evaluate the effectiveness of a SNAP subsidy program [69]. The 2014 Farm Bill subsequently authorized $100 million for the Food Insecurity Nutrition Incentive (FINI) Grant Program, which has led to an increased number of subsidy programs targeted at low-income individuals [21]. Key policy elements and characteristics for these subsidy programs (Table 3) included level of government (federal, state, local), target population (SNAP participants, WIC participants, low-income seniors), dietary target (most commonly fruits and vegetables, including starchy vegetables), dietary target definition (product/category-based), type of subsidy (price discount, cash-value benefits), subsidy rate (e.g., $410/month, or $0.25-$1 in subsidy per dollar spent), and implementation mechanism (e.g., coupons/checks, discounts at point of purchase, or rebate on SNAP or WIC Electronic Benefit Transfer card).

Improvements to Government Food Assistance Programs - SNAP Restrictions for Unhealthy Food

For unhealthy food restrictions through SNAP, we identified 57 policy cases: 1 joint state/local waiver request, 52 state bills, and 4 federal bills (Resource 3, Table 2). Some of the state bills sought permission to conduct pilot studies; others aimed to seek waivers from the USDA or pass a resolution urging Congress to regulate SNAP-eligible foods. Two federal bills proposed amendments to the Farm Bill to allow for demonstration projects, and two proposed changes to SNAP-eligible foods. Policy elements included level of government (local, state, federal), regulatory approach (mandatory), target population (SNAP recipients), dietary target and definition, form of restriction (e.g., restricting unhealthy foods, limiting benefits to healthy foods), and implementation mechanism. The majority of bills proposed a restriction on SSB purchases (broadly defined to include various SSB types or specific SSB product such as energy drinks) using SNAP benefits. Fewer proposed a broader overhaul to the list of eligible foods, either by banning “junk” food purchases (mostly defined by product categories, e.g., SSBs, candy, chewing gum, high-fat chips, cookies, crackers,

snacks, ice cream; few defined by nutrient cutoff, e.g., “food containing at least 400 mg of salt per serving or 37.5g of sugar per 100g serving”) or by restricting use of SNAP benefits to healthy food alone (e.g., WIC-eligible foods). Potential implementation mechanisms identified from the literature included updating the SNAP eligible-food list (similar to how WIC-eligible foods are regularly updated and communicated to retailers), creating an app to notify SNAP recipients whether a product is eligible, or using the existing sales tax systems to identify ineligible foods [70].

DISCUSSION

The present investigation assessed the extent of proposal and adoption of new dietary policies to improve cardiometabolic health in the US, and provided a guiding framework for characterizing key elements in their design. Selected dietary policies were organized in 5 domains including food prices (SSB taxes, unhealthy food taxes, healthy food subsidies), reformulation (*trans*-fat, sodium), labeling (FOP, NFP, menu calorie labeling, health warning), marketing (mass media campaigns for healthy foods or against unhealthy foods, and marketing restrictions for children), and improvements to government food assistance programs (healthy food subsidies and SNAP restriction). Our results suggest that federal, state, local and tribal actions varied by dietary policy, lacking a coherent agenda. These findings can inform public health planning and highlight priority areas for strategies to reduce diet-related cardiometabolic burdens and disparities. Specific policy elements greatly overlapped across domains and policies, while others were domain-specific or policy-specific. Characteristics of each element generally differed across policies, and crucially for policy cases within the same policy, indicating the need to clearly and sufficiently characterize key policy elements for achieving intended policy effects.

Policies adopted at the federal level in recent years included *trans*-fat elimination, updating the NFP to disclose added sugar (among other changes), menu calorie labeling, mass-media campaigns to promote fruit and vegetable consumption, and healthy food (primarily fruits and vegetables) subsidies for low-income individuals (such as in SNAP). Moderate level of federal action was seen for sodium reformulation and food marketing to children with government-led voluntary guidelines for the industry; least for SSB taxes, FOP labeling and SNAP unhealthy food (mainly SSB) restriction with only proposed bills; and none for whole population healthy food subsidies, unhealthy food taxes, mass-media campaigns against unhealthy food, and health warning (SSB, sodium) labels. At the state level, adopted policies included healthy food mass-media campaigns and subsidies for low-income individuals; SSB taxes, marketing restrictions for children, and SNAP restriction were being actively proposed in multiple bills. Fewer state efforts were observed for unhealthy food taxes, healthy food subsidies for the whole population, mass-media campaigns against unhealthy food, and health (SSB) warning labels. Local efforts varied significantly, with a number of localities (e.g., NYC, San Francisco, Philadelphia) consistently leading in the adoption of these policies, most notably SSB taxes, sodium reformulation, mass-media campaigns, health warning labels, and healthy food subsidies for low-income individuals.

Our findings indicate a shift in the US food policy agenda away from fat as the key nutrient to target, consistent with recent guidelines [23]. Several of these policies targeted added

sugar, especially from SSBs, such as revising the NFP to remove calories from total fat and disclose added sugar content, SSB taxes, restricting SSB purchases in SNAP, and SSB health warning labels. Of those, excise taxes to increase price of SSBs are a particularly powerful, effective and cost-effective policy tool to decrease consumption, increase revenue and reduce health burdens and costs [71, 16, 72, 73]. The growing trend in local and state SSB taxes is especially noteworthy, with 8 localities enacting SSB excise taxes since 2014 and more than 30 states and localities actively proposing similar taxes. Though local and state laws are subject to potential preemption by the federal government, this is not necessarily warranted in the case of food policies such as SSB excise taxes [74], while conditions necessary for political success inform the spread and feasibility of such efforts [17]. The 2018 Farm Bill, whose largest component is SNAP, represents a major opportunity to reduce disparities in diet and health [75]. Restricting SSB purchases or implementing a broader food incentive/disincentive framework that preserves choice could be an effective and cost-effective policy option [76, 77]. Considering the unique health harms attributed to SSB consumption [1, 78–80], continuing and expanding effective, practical and feasible policies to reduce SSB consumption is a vital step towards improving cardiometabolic health.

Comparatively fewer efforts were employed to reduce sodium intake, despite being a leading cause of cardiometabolic disease in the US [1]. The National Sodium Reduction Initiative led by NYC was the only sodium reformulation program we identified, with modest industry progress [81]. Though the FDA has proposed voluntary sodium reformulation targets, it was instructed by Congress not to advance the final guidance to food manufacturers in the 2017 congressional budget and the 2018 House Agriculture appropriations bill [82, 83]. A potential reason could be industry opposition, due to technical barriers, high reformulation costs, and fear of losing market share to competitors that choose not to reformulate and alter product taste [52]. Yet, achieving the FDA sodium reduction targets would generate substantial health gains and reduce disparities [84], while benefits for the overall food industry with a healthier workforce could offset reformulation costs [85]. Mandated population-wide salt reduction policies or voluntary strategies with high industry compliance to level the playing field (for example as implemented in the UK and Turkey) should be prioritized to reduce sodium-related health and economic burdens [86, 87]. Industry engagement is crucial in implementing dietary policy solutions to improve cardiometabolic health, particularly for developing and marketing healthier foods. Mandatory regulation for policies that implicate the First Amendment’s protection for speech, such as FOP labeling and marketing restrictions, may have also been limited due to legal constraints, industry self-regulation, and governments’ concerns over being sued and having to defend its laws in court [88, 89]. Working with the industry to set higher standards for self-regulation with strong government-led monitoring/evaluation and appropriate incentives (or disincentives) could be a promising solution [63, 89].

Consistent with the well-established links of fruit and vegetable consumption with cardiometabolic benefits [1, 90, 91], most US dietary policies targeting healthy food focused on fruits and vegetables. These targets are easier to define (product-based) and for consumers to recognize, and further align with recent local food movements to promote farmers market usage [21]. Yet, policies to increase fruit and vegetable consumption were limited to mass-media campaigns and small financial incentives to low-income,

nutritionally-at risk populations. Evidence from comparative-effectiveness studies suggests that modest whole population fruit and vegetable subsidies could be more effective in reducing disease burden and disparities than larger subsidies among low-income individuals [92] or mass-media campaigns [93]. Considering growing nutritional science and the relevance of other (beneficial, harmful) foods and overall dietary patterns for health [1, 94], the lack of focus on other foods (other than fruit and vegetables, and SSBs) is striking. Nuts/seeds, whole grains, seafood and plant-based oils (rich in polyunsaturated fats) are each strongly and independently associated with cardiometabolic benefits [1], and processed foods (e.g., processed meats) high in sodium, added sugar and low in fiber and healthy fats are linked to harm [95]. This could be partly attributed to complexities in defining and categorizing healthy or unhealthy food and increased costs associated with subsidizing healthy food [96]. A category- and nutrient-based approach is a feasible option to define healthy and unhealthy food [45]. Further, utilizing novel technology platforms and validated FOP labels could help consumers identify those foods and reduce administrative burden [97, 98]. Benefits of unhealthy food taxes for both health and disparities would be strongly complemented by accompanying strategies to reduce the price of healthy food [99, 100]; such a combined strategy could be more effective than each policy alone [99, 100]. Subsidies are essential to improve diets, as well as minimize the regressive nature of taxation alone [96]; utilizing existing infrastructure to deliver the subsidy (e.g., EBT-type smart card system) could minimize administrative burden [101, 102].

Furthermore, our findings suggest that certain elements in the dietary policy design were common across domains and policies, such as level of government, target population, dietary target and definition, and implementation mechanism. The characteristics of level of government, target population, dietary target and implementation mechanism were policy-specific, but similar dietary targets in different policies (e.g., healthy food in media campaigns, or in subsidies) were relatively consistently defined. Level of government reflected federal, state, local or tribal motivation to act, and was further determined by the state or local legal authority to act (e.g., whether they were preempted). Most policies targeted the whole population (e.g., taxes, reformulation, labeling), and fewer targeted specific populations (e.g., children for marketing restrictions; low-income individuals for subsidies). Dietary targets were defined using three approaches (product/category-based, nutrient-based, or product + nutrient-based), and the selected approach differed by dietary target (e.g., SSBs typically defined by a product and calories approach; unhealthy food typically defined by a product- and nutrient-based approach). Implementation mechanism was clearly (e.g., taxes) or inherently (e.g., labeling schemes, sodium reformulation) defined for certain policies, but less so for others (e.g., subsidies for whole population, SNAP restriction).

In addition to these overlapping elements, other elements were domain-specific (e.g., location or type of label for labeling schemes, media channels for mass-media campaigns and marketing restrictions) or policy-specific (e.g., tax base, messaging for mass-media campaigns, warning language for health warning label). Of note, while characteristics of some of these policy elements were similarly defined (e.g., warning language used in most SSB warning labels), characteristics of other policy elements varied across policy cases within a given dietary strategy (e.g., tax base for SSB taxes, messaging in mass-media

campaigns to promote fruits and vegetables, or media channels and physical settings where marketing restriction to children may be implemented). Additionally, we observed that crucial policy elements were not clearly defined or even missing in some policy cases. For example, some of the unhealthy food tax bills did not specify the tax rate, and several bills on marketing restrictions did not define the foods to which the restrictions would apply. A bill proposing a healthy food pilot program aimed to target “selected needy population dealing with the most serious health challenges” by promoting “low-fat, antioxidant-rich foods [46]” without other specifications. Intended policy effects cannot be achieved when key details in the policy design are overlooked.

Variation in the characteristics of key elements could have important implications on the intended policy effect, such as dietary behavior change, industry response and health impact. For instance, the tax base for most SSB excise taxes was on the beverage volume, thus taxing beverages with high and low sugar content equally. Yet, sugar content differs greatly by types and brands of SSBs; a graduated, tiered tax (where SSBs with higher sugar content are taxed at a higher rate per ounce) or a tax based on grams of sugar may be more effective to discourage intake of high-sugar beverages and may further incentivize industry reformulation [43, 45]. Choice of FOP type and label design, such as a color-coded design could increase user attention compared to words [98], and may be easier for consumers to interpret compared to nutrient-specific design with only numeric information [103]. We also found that selection and definition of dietary targets did not always align with diet-disease evidence linking the dietary target to intended health outcome. The WIC Fruit and Vegetables Cash Vouchers allow participants to purchase white potatoes [104], despite strong evidence linking potato consumption with weight gain and diabetes [105]. To raise the revenue potential, the Philadelphia SSB tax included diet soda, yet its link to health harms is not clearly established [106].

Strengths of this investigation include evaluating the extent of proposal and adoption across a wide range of dietary policies to improve cardiometabolic health. No existing literature has to our knowledge provided a timely review of the status of proposal and adoption of these policies at the federal, state, local and tribal level. State and local policies are often proving grounds for effective policies that can be brought to national scale; given potentially evolving priorities of the federal government, understanding state and local policy options and identifying which policies have been heavily pursued or neglected is particularly relevant. Additionally, we categorized and characterized key elements crucial in the policy design using novel methods and diverse sources. Policymakers and researchers should examine these key elements and compare how variation in their characteristics could affect the health impacts, costs, and feasibility of a given policy.

Potential limitations should be considered. We did not assess the evidence-base of selected policy strategies, and relied on ours’ and other’s prior extensive work. The list of strategies is not exhaustive; we excluded policies where significant progress has already been made. Our search of policy cases was not comprehensive due to the lack of a central database that tracks of programs, agency regulations and local bills; yet, our search of multiple online resources and expert consultations made it less likely that we missed major relevant efforts. We focused on government-led efforts thus excluding non-governmental and private sector

efforts, such as healthy food subsidy programs from insurers [107, 108] and nongovernmental organizations [109, 110], industry-led FOP labels [111–113], reformulation efforts [114, 115] and marketing standards [116]. Future work should evaluate the design and implementation of such efforts. Lastly, we focused on the design of these dietary policies and did not assess how the policy should be monitored or evaluated. The selected key elements highlight only the minimum set of elements that could affect the cardiometabolic impact of a given policy, and additional elements could be evaluated on a policy-specific basis.

Conclusion

Adoption of new evidence-based dietary policies to improve cardiometabolic health has been incremental and inconsistent at the US federal, state, and local levels. Key elements and their definitions in the policy design, such as target population, dietary target definition, and implementation mechanism could have implications on the policy's intended effect that should be explored in future research. These findings highlight key priority areas and inform the design of dietary policies to improve cardiometabolic disease in the US.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

The authors thank all of the collaborators and advisory groups in the Food Policy Review and Intervention Cost-Effectiveness (Food-PRICE) project (www.food-price.org).

Funding: This research was supported by the NIH, NHLBI (R01 HL130735, PI Micha). The funding agency did not contribute to design or conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

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•• Of major importance

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Table 1.

Selected Evidence-Based Dietary Policies for Improving Cardiometabolic Health in the US.[a]

Policy Domain	Diet Policy
Food Prices	**#1.** Tax strategies to increase prices of less healthful foods.[b] **#1a.** Tax on sugar- sweetened beverages [SSB tax]. **#1b.** Tax on other unhealthy foods ["junk" food tax]. **#2.** Subsidy strategies to lower prices of more healthful foods [healthy food subsidy].
Food Reformulation[c]	**#3.** Reformulation or regulatory strategies to reduce less healthful nutrients in packaged and commercially prepared foods. **#3a**. Restriction on the use of trans-fat [trans-fat restriction] **#3b**. Reformulation to reduce sodium content [sodium reformulation].
Food Marketing	**#4.** Mass-media and educational campaigns (MMC). **#4a**. MMC to promote specific healthier foods [healthy food MMC]. **#4b.** MMC to advertise against specific less healthful foods [unhealthy food MMC] **#5.** Restriction of unhealthy food marketing to children [marketing restriction].
Food Labeling	**#6.** Front-of-package labels to disclose simplified information on the nutritional quality of packaged foods [FOP labeling]. **#7.** Disclosure of nutrition facts on packaged foods [Nutrition Facts Panel]. **#8.** Disclosure of nutrition information at restaurants and other retail food establishments [menu labeling]. **#9.** Health warning labels indicating the health risks associated with unhealthy food consumption [health warning label].
Improvements to Government Food Assistance Programs	**#10.** Financial incentives for purchasing healthier foods for participants in government food assistance programs, such as Supplemental Nutrition Assistance Program (SNAP) and Special Supplemental Nutrition Program for Women, Infant and Children (WIC) [SNAP/WIC subsidy]. **#11.** Restricting purchasing of less healthful foods for SNAP participants [SNAP unhealthy food restriction].

[a]This review focuses on new and emerging dietary policies to improve cardiometabolic health. Thus, we did not review more established programs such as the Dietary Guidelines for Americans [23], the National School Lunch Program [24], or Meals on Wheels [25]; or other policies focused on nutrient deficiencies (e.g., salt iodization, folic acid fortification), other health and safety issues (e.g., water sanitation, additives, coloring), general lifestyle (e.g., physical activity, obesity, alcohol, smoking), and policies not having a direct focus on nutrition (e.g., agricultural subsidies, environmental or trade policies). We also excluded organizational food environment initiatives (e.g., nutrition standards in the workplace) and built environment strategies (e.g., proximity to food store locations), as such policies continue to have more limited evidence for efficacy to improve cardiometabolic health [26–28]. We did not include school, afterschool, and early childcare food policies in the present review (e.g., nutrition standards in the National School Lunch and School Breakfast Program, the Child and Adult Care Food Program, the Fresh Fruit and Vegetable Program, Smart Snacks regulation), as these policies have been extensively documented elsewhere [29–37].

[b]"Food" refers collectively to foods and beverage

Table 2.

Dietary Policies Recently Adopted by US Local, Tribal, State and Federal Governments, and Proposed by the Federal Government [a], for Improving Cardiometabolic Health.

Diet Domains and Policies	Policy Case	Type[b]	Level of Government[c]	Time[d]
Food Prices				
SSB tax[e]	Berkeley, California tax [117]	Law	Local	2014 –
	Philadelphia, Pennsylvania tax [106]	Law	Local	2016 –
	San Francisco, California tax [118]	Law	Local	2016 –
	Albany, California tax [119]	Law	Local	2016 –
	Oakland, California tax [120]	Law	Local	2016 –
	Boulder, Colorado tax [121]	Law	Local	2016 –
	Cook County, Illinois tax [122]	Law	Local	2016 –
	Seattle, Washington SSB tax [123]	Law	Local	2017 –
	Navajo Nation Healthy Dine Act of 2014 [124]	Law	Tribal	2014 –
	Federal bill H.R. 5279 Sweet Act [40]	Bill	Federal	2013
	Federal bill H.R. 1687 Sweet Act [41]	Bill	Federal	2015
"Junk" food tax[f]	Navajo Nation Healthy Dine Act of 2014 [124]	Law	Tribal	2014 –
	Texas Tax Code 151.314 [125]	Law	State	2013 –
	Maine law 36 MRS. 1811; 36 MRS. 1752 [126]	Law	State	2016 –
Healthy food subsidy	Navajo Nation Sales Tax (eliminating tax on fresh fruits, fresh vegetables, water, nuts, seeds and nut butters) [127]	Law	Tribal	2014 –
Food Reformulation				
Trans-fat restriction[g]	FDA Final Determination Regarding Partially Hydrogenated Oils [50]	Law	Federal	2015 –
Sodium reformulation	New York City, NY, National Sodium Reduction Program Initiative [128]	Program	Local	2009 –
	FDA's voluntary sodium reduction guidelines [22]	Guidelines	Federal	2016
Food Marketing				
Healthy food MMC[h]	San Diego, CA "5-2-1-0" Campaign [129]	Program	Local	2011 –
	Los Angeles, CA "Choose Less Weigh Less" campaign [130]	Program	Local	2011 – 2012
	San Francisco, CA "Eat Fresh" campaign (SNAP Ed) [131]	Program	Local	2013 –
	New York City, NY "Take me with you" Campaign [132]	Program	Local	2014 –

Diet Domains and Policies	Policy Case	Type[b]	Level of Government[c]	Time[d]
	San Antonio, TX “Viva Health” Campaign [133]	Program	Local	2017 –
	Arizona “Simple Goodness” campaign (SNAP Ed) [134]	Program	State	n/a
	California “Eat Fresh” campaign (SNAP Ed) [131]	Program	State	n/a
	Iowa low fat milk campaign (SNAP Ed) [135]	Program	State	n/a
	Maine “Healthy Weight Awareness” campaign (SNAP Ed) [136]	Program	State	2002 – 2012
	Wyoming “Cent$ible Nutrition Program” (SNAP Ed) [137]	Program	State	2003 –
	Iowa “Pick a Better Snack” campaign (SNAP Ed) [138]	Program	State	2011
	Oregon “Food Hero” campaign (SNAP Ed) [139]	Program	State	2011
	Michigan “They Learn from Watching You” campaign (SNAP Ed) [140]	Program	State	2012
	Oklahoma “The Whole Milk Truth” campaign (SNAP Ed) [141]	Program	State	2012 – 2014
	South Dakota “Pick it! Try it! Like it!” campaign (SNAP Ed) [142]	Program	State	2014
	Rhode Island mass transit social marketing campaign (SNAP Ed) [143]	Program	State	2016
	Fruit and Veggies More Matters (formerly 5 a Day) [53]	Program	Federal	2007 –
	Let’s Move! [54]	Program	Federal	2010 – 2016
Unhealthy food MMC[h]	New York City, NY “Pouring on the Pounds” campaign [144]	Program	Local	2009
	San Francisco, CA “Pouring on the Pounds” campaign [145]	Program	Local	2010
	Los Angeles, CA Choose Health LA Sugar Pack campaign [146]	Program	Local	2011 – 2012
	Philadelphia, PA “Food Fit Philly” campaign [147]	Program	Local	2013 –
	New York City, NY “Drinking yourself sick” campaign [148]	Program	Local	2013 – 2014
	New York City, NY campaign highlighting the health risks of children consuming SSBs [149]	Program	Local	2015
	Baltimore, MD “Rethink Your Drink” campaign [150]	Program	Local	2016
	Nevada “Rethink Your Drink” campaign (SNAP Ed) [151]	Program	State	2011
Marketing restriction	San Francisco, CA Health Food Incentives Ordinance [58]	Law	Local	2011 –
	Santa Clara, CA Ordinance No 300–820 Toys and other incentives with restaurant food [59]	Law	Local	2010 –
	Maine ban of brand-specific advertising of certain unhealthy food and beverages on school grounds [55]	Law	State	2007 –
	California A.B. 841: pupil nutrition: food and beverages: advertising: corporate incentive programs (Section 49431.9 in the Education Code) [57]	Law	State	2017 –
	Local school wellness policy implementation under the Healthy, Hunger-Free Kids Act of 2010 [56]	Law	Federal	2016
	Interagency Working Group Principles [60]	Guidelines	Federal	2012
	Federal Bill H.R. 4310 - Deny tax deductions for food advertising and marketing directed at children [152]	Bill	Federal	2010
	Federal Bill H.R. 6599 - Stop subsidizing childhood obesity act [153]	Bill	Federal	2012

Diet Domains and Policies	Policy Case	Type[b]	Level of Government[c]	Time[d]
	Federal Bill S.B. 2342 - Stop subsidizing childhood obesity act [154]	Bill	Federal	2013
	Federal Bill. H.R. 2831 – Regarding tax subsidies and advertising to children [155]	Bill	Federal	2013
	Federal Bill S.B. 39 – HELP America Act [156]	Bill	Federal	2013
	Federal Bill H.R. 5232 – Stop subsidizing childhood obesity act [157]	Bill	Federal	2016
	Federal bill S.B. 2936 – Stop subsidizing childhood obesity act [158]	Bill	Federal	2016
Food Labeling	Federal Bill H.R. 3147 Food Labeling Modernization Act of 2013 [159]	Bill	Federal	2013
FOP labeling	Federal Bill S.B. 1653 Food Labeling Modernization Act of 2013 [160]	Bill	Federal	2013
	Federal Bill H.R. 4061 Food Labeling Modernization Act of 2015 [161]	Bill	Federal	2015
	Federal Bill S.B. 2301 Food Labeling Modernization Act of 2015 [162]	Bill	Federal	2015
Nutrition Facts Panel	Nutrition Facts Panel (mandated by the Nutrition Labeling and Education Act of 1990) [19]	Law	Federal	1990[i]
Menu labeling[j]	Nutrition Labeling of Standard Menu Items (section 4205 of the Patient Protection and Affordable Care Act of 2010) [18]	Law	National	2010 –
Health warning label	New York City, NY sodium warning rule (Article 81 of the New York City Health Code) [163]	Law	Local	2015 –
	San Francisco, CA Ordinance Sugar-sweetened beverage warning for advertisements (No. 100–15 Health Code) [164]	Law	Local	2015[k]
Improvements to Government Food Assistance Programs				
SNAP/WIC subsidy[l]	New York City, NY Health Bucks program [165]	Program	Local	2005 –
	Boston, MA Bounty Bucks program [166]	Program	Local	2008 – 2016
	Philadelphia, PA Philly Food Bucks program [167]	Program	Local	2010 –
	Yolo, CA Bonus Bucks program [168]	Program	Local	2015 –
	Aurora, IL Bonus Value Tokens program [169]	Program	Local	2015 –
	Guilford, NC Double Bucks program [170]	Program	Local	2015 –
	Madison & Dane County, WI SNAP subsidy program [171]	Program	Local	2016 –
	Massachusetts Healthy Incentive Program [172]	Program	State	2015 –
	Washington Veggie RX program [173]	Program	State	2015 –
	Vermont produce prescription project [174]	Program	State	2016 –
	WIC Farmers' Market Nutrition Program [68]	Program	Federal	1992 –
	Senior Farmers' Market Nutrition Program [67]	Program	Federal	2007 –
	WIC Cash Value Voucher [175]	Program	Federal	2007 –
	Healthy Incentives Pilot [69]	Program	Federal	2011 – 2012

Diet Domains and Policies	Policy Case	Type[b]	Level of Government[c]	Time[d]
	Federal bill H.R. 3072 – Local Food for Healthy Families Act of 2013 [176]	Bill	Federal	2013
	Federal bill H.R. 4904 - Vegetables Are Really Important Eating Tool for You (VARIETY) Act of 2014 [177]	Bill	Federal	2014
	Food Insecurity Nutrition Incentive (FINI) Grant Program [21]	Program	Federal	2015 –
	Federal bill H.R. 5423 - SNAP Healthy Incentives Act of 2016 [178]	Bill	Federal	2016
SNAP restriction	Senate Amendment 1152 to S. 954 (amendment to the farm bill to allow for demonstration projects [179]	Bill	Federal	2011
	Senate Amendment 2235 to S. 3240 (amendment to the farm bill to allow for pilot projects) [180]	Bill	Federal	2012
	Federal bill H.R. 3073 - Healthy Food Choices Act of 2013 [181]	Bill	Federal	2013
	Federal bill H.R. 4881 - Healthy Food Choices Act of 2016 [182]	Bill	Federal	2016

[a] See recent policies proposed by local and state governments to improve cardiometabolic health in Resource 2 and Resource 3.

[b] The type of policy case indicates its legislative status: laws are enacted; bills and guidelines are proposed. Programs are implemented.

[c] Refers to the level of US government that initiated the policy/program, including local, state and federal, and not necessarily the geographic area the policy/program targets. For instance, the National Sodium Reduction Initiative was led by a local government (NYC), but was designed as a program and collaborated with other state and local agencies to encourage reformulation nationwide.

[d] For laws, time indicates the year the law was enacted; for bills, the year the bill was proposed; for programs, the year the program was implemented; and for government-led voluntary guidelines, the year they were proposed. Dash (–) indicates that a law or program is ongoing.

[e] In addition to these new SSB taxes, 34 US states and the District of Columbia also tax SSBs as part of their general sales tax and 7 states have excise tax on SSBs for revenue purposes (the majority of which were enacted before 2010) [38].

[f] In addition to these laws, 12 states have broad taxes on food (which would additionally include “junk” food). We did not include these laws given these taxes do not specifically target unhealthy food [39].

[g] We did not search for local and state *trans*-fat laws as the FDA’s ban on partially hydrogenated oil rendered any prior local and state *trans*-fat policies irrelevant.

[h] Supplement Nutrition Assistance Program Education (SNAP Ed) is the nutrition promotion and obesity prevention component of SNAP.

[i] The Nutrition Facts Panel was mandated by law in 1990; important revisions were issued in 2003 (*trans*-fat labeling) [47] and 2016 (disclosure of added sugar content, Daily Value update, serving size change, new format design, among other changes).

[j] We did not search for state menu labeling bills as the federal menu labeling law preempts state and local menu labeling laws (that apply to the same restaurants and are not identical to federal law).

[k] The warning label ordinance was passed in 2015, but was recently blocked by the 9th Circuit Court of Appeals from implementation [66].

[l] Food Insecurity Nutrition Incentive (FINI) Grant Program has awarded grants to numerous nonprofits and state/local governments to implement SNAP subsidy programs. In this table, we only included programs where the grant was awarded to state/local governments.

Table 3.

Key Policy Elements and Characteristics of Food Price Policy Design to Improve Cardiometabolic Health.

Policy Elements	SSB tax	"Junk" food tax	Healthy food subsidy[a]
Level of government[b]	federal, state, local, tribal	federal, state, local, tribal	federal, state, local, tribal
Target population	whole population	whole population	whole population, seniors, low-income population (participants of SNAP, WIC, seniors)
Dietary target	SSBs, sweetened beverages, soft drinks, sugary drinks, beverage high in calories and sugar, beverages that contained added sugar	snack food, junk food, minimal-to-no nutritional value foods, non-grocery staples, non-foods	fruit and vegetables, water, "fresh", "healthy," "staple" or "unprepared" food[c]
Dietary target definition	product + calorie-based[d]	product-based definition[e] nutrient-based definition[f] product + nutrient-based definition	product-based definition
Type of tax[g]	excise tax, sales tax, gross-receipts tax	excise tax, sales tax, gross-receipts tax	n/a
Tax base and tax rate[h]	price-based: 0.5%−6.5% (sales/gross-receipts) volume-based: 0.5–3 cents/oz (excise) volume-based: 5–25 cents/deposit container (sales/excise) tiered[i], volume-based: 1–2 cents/oz (excise) sugar content-based: 1 cent/1 tsp. of sugar (excise)	nutrient based: 0.05 cent/g of sugar price-based: 0.25–5.5% (sales/gross-receipts tax)	n/a
Subsidy scheme and rate[j]	n/a	n/a	tax exemption (% vary); price discount (% vary); cash-value benefit ($4– 10/month, or $0.25-$1 per dollar spent)
Implementation mechanism	excise tax: levied on manufacturers, distributors, wholesalers and retailers; sales tax: paid by consumers and collected by retailers at the point of sale; gross-receipts tax: levied on the business activity of the seller	excise tax: levied on manufacturers, distributors, wholesalers and retailers; sales tax: paid by consumers and collected by retailers at the point of sale; gross-receipts tax: levied on the business activity of the seller	paper/electronic coupons/vouchers, tokens, checks, discounts at point of purchase, rebate on store-loyalty card or EBT-type card after purchase
Earmarking[k]	child obesity prevention, Medicaid, health research, medical school fund	child obesity prevention, healthcare	n/a

[a] Subsidies to participants of government food assistance programs (policy strategy #10) are covered here.

[b] Level of government refers to the level of government at which policy cases were identified in the US. The legal authority for federal, state and local government to enact these dietary policy strategies is outside the scope of this review.

[c] "Fresh", "Healthy", "unprepared" or "staple" foods may include fruits and vegetables, seeds, nuts and nut butters, whole grains, beans and legumes, raw animal products (e.g., eggs, meat, poultry, fish, milk), bread and baking ingredients.

[d] Sugar-sweetened beverages (SSBs) were typically defined by product category (e.g., soda, sports drinks, energy drinks, fruit drinks, and presweetened tea and coffee) and calorie/sugar content cut points (e.g. ≥2 calories per oz. or ≥5g of added sugar per 12 oz). Artificially sweetened beverages are included in some cases. Milk, milk-based drinks, 100% juice, water, coffee and tea without added sweeteners, dietary supplements, medical beverages, oral electrolyte solutions, and infant formula are typically excluded.

[e] Taxed products may include SSBs, candy, chips, pretzels, desserts, frozen desserts, baked goods, cereals/granola bars, processed meat products.

[f] Nutrient-specific cut-points to target e.g., added sugar, sodium, saturated fats.

[g] Sales tax is imposed on the retail sale of taxed products; it is an *ad valorem* tax proportional to the price of the products. An excise tax is typically imposed on the manufacturers or distributor, and it is typically a per unit tax (e.g., volume or weight). Manufacturers or distributors may choose to pass the cost of the excise tax onto consumers, in which case the tax would be reflected on the price tag of the products. Compared to sales tax, an excise tax typically results in a higher price increase of the taxed products and is more visible to consumers compared to sales tax (which is visible only at point-of-purchase). Gross-receipts is a tax on the gross revenue of a business.

[h] Rate of tax is not specified in some policy cases.

[i] One example is the Massachusetts bill S.B.1562, which proposed a tiered tax approach: tier 1: not taxed; tier 2: 1 cent/oz; tier 3: 2 cents/oz. (Tier 1: beverages with less than 5g of added sugar per 12 oz.; Tier 2: beverages with between 5 −20g of added sugar per 12 oz.; Tier 3: beverages with >20g of added sugar per 12 oz.).

[j] Rate of subsidy is not specified in some policy cases.

[k] Earmarking is a budgeting practice that dedicates tax revenue to a specific program or purpose. Earmarking was identified for a variety of purposes, and those related to health were listed here. Earmarking was observed for excise taxes and gross-receipts tax as sales tax revenue is generally deposited into the general treasury.

Curr Atheroscler Rep. Author manuscript; available in PMC 2019 April 14.