Review article

Dietary policies and programs in the United States: A narrative review

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ABSTRACT

Prior reviews describing approach, methodological quality and effectiveness of dietary policies and programs may be limited in use for practitioners seeking to introduce innovative programming, or academic researchers hoping to understand and address gaps in the current literature. This review is novel, assessing the "where, who, and in whom" of dietary policies and programs research in the United States over the past decade – with results intended to serve as a practical guide and foundation for innovation. This study was conducted from October 2018 to March 2019. Papers were selected through a tailored search strategy on PubMed as well as citation searches, to identify grey literature. A total of 489 papers were relevant to our research objective. The largest proportion of papers described school-based strategies (31%) or included economic incentives (19%). In papers that specified demographics, the study populations most often included children, adults and adolescents (54%, 46%, and 42% respectively); and White, Black and Hispanic populations (77%, 76% and 70%, respectively). Results highlight opportunities for future research within workplace and faith-based settings, among racial/ethnic minorities, and older adults.

1. Introduction

The rise of overweight, obesity and cardiovascular disease (CVD) in the United States (U.S.) has led to increased pressure on policy makers to implement changes to promote healthy diets. Projections estimate that over 85% of adults may be overweight or obese by 2030 and 45.1% of adults may have some form of CVD by 2035 (Wang et al., 2008; Khavjou et al., 2016). Dietary behaviors are among the most important, modifiable risk factors for overweight and obesity as well as long-term CVD outcomes (Micha et al., 2017). For example, sodium and sugar-sweetened beverage (SSB) consumption have been well documented as increasing body mass index (BMI), waist circumference (WC), as well as the risk of CVD, stroke, and fatal coronary heart disease (CHD) (Bahadoran et al., 2015; Bechthold et al., 2017; Graudal et al., 2014; Micha et al., 2017; Ruanpeng et al., 2017; Moosavian et al., 2017). Conversely, fruits and vegetable consumption have been inversely associated with body weight, WC, central adiposity and risks of CVD, CHD, stroke and heart failure (Bechthold et al., 2017; Zhang and Zhang, 2018; Mytton et al., 2017; Schwingshackl et al., 2015).

Recent reviews and reports have described dietary policies and programs and/or rated their methodological quality and effectiveness providing valuable roadmaps for public health practitioners and policymakers (Mozaffarian et al., 2012; Afshin et al., 2015; Fisher, 2016).

Strategies have included mass media and education campaigns, food labelling requirements, economic incentives, local environmental changes, regulatory restrictions and mandates (e.g., reformulation), and place-based initiatives (e.g., school, workplace, and faith-based settings). Our intention is not to replicate or update these prior reports on how well these existing dietary policies and programs function in improving diet and related health outcomes. Instead, to the best of our knowledge, no review has evaluated the proportion of the literature that has been published on each of these strategies and their target populations, which would address questions such as, "What are the most frequently researched strategies?"; "In what setting(s) have these strategies been studied?"; or "Have most strategies included adults, or children?" The objective of our review was to provide these additional statistics, and identify gaps in current dietary policies and programs in the U.S. in the past decade. In addition to providing disaggregated data on policies and programs by population characteristics, our review is novel in that we included a broad range of study designs and grey literature.

This overview of literature will assist future research in prioritizing efforts to populations that have been previously understudied, and serve as a practical guide for health practitioners and academics to move beyond what has been previously been studied, and towards innovative strategies. Herein we identify trends in policy and program

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research with regards to focus area and timelines; characterize the populations that have been targeted and/or studied; and make recommendations for future research.

2. Methods

2.1. Study design

This review was conducted between October 2018 and March 2019. The aim of this overview of the literature was to understand what is known from existing literature about dietary policies and programs implemented in the U.S. and the trends in strategies used and populations studied over the past 10 years. We systematically searched an online database, PubMed to identify relevant papers; searched citations of identified articles to source grey literature; selected articles that best fit our question; abstracted data and then summarized the results.

2.2. Search strategy

A search strategy was developed to identify relevant papers. Dietary policy and program categories were defined *a priori* based on a recent review (Mozaffarian et al., 2012). Search terms included vocabulary related to the key concepts: policy, program, diet, and strategy. Strategies included: mass media and education campaigns, food labelling requirements, economic incentives, local environmental changes, regulatory restrictions and mandates, and school, workplace, and faith-based focused initiatives. An independent PubMed search was conducted for each dietary policy and program strategy and the results combined. Additional documents were identified using snowball searches of citations and reference, in order to better represent grey literature. Reports from government agencies and non-profit organizations were included in our review. Results were limited to English-language documents, published between 2008 and 2018 (the past ten years). The search was conducted on PubMed in October 2018.

2.3. Study selection

This overview includes peer-reviewed papers and grey literature on policies and programs in the U.S. that directly or indirectly affect dietary behavior. Dietary behaviors include overall eating patterns (e.g., caloric intake), and specific food consumption (e.g., fruits and vegetables, sugary drinks intake). Articles identified through the database search were reviewed for relevance in two stages. Inclusion criteria were that papers were published after 2008, in the United States, and assessed an intervention, policy, or program that affected dietary behavior. Reviews (narrative, systematic, scoping) and studies of all types (i.e., qualitative and quantitative) were included. Excluded articles were those describing international policies/programs, or were commentaries, legal briefs, or letters to the editor. This review includes articles that were peer-reviewed and grey literature, and excludes letters to the editor, opinions, and commentaries. Two reviewers (RR, SC) independently screened titles and abstracts of selected papers and excluded those that did not meet the inclusion criteria. Full texts were assessed further for eligibility by RR and SC. Conflicts were settled through discussions between reviewers.

2.4. Data abstractions

Two reviewers (RR, SC) extracted data from the relevant articles using a standardized Excel spreadsheet. This form included a study identification number, publication year, sample characteristics, strategy type, and level of policy or program. Sample characteristics of the study and target populations included ages and races. Ages were grouped into four categories: children, ages 2–12 years; adolescents, ages 13–17 years; adults, 18–64 years; and older adults, ≥65 years. Race/ethnicity was disaggregated into White, Black, Hispanic, Asian, Native

Hawaiian Pacific Islander (NH/PI), and American Indian or Alaska Native (AI/AN). Mexican was collapsed into the Hispanic category. Otherwise, when included race categories representing two or more races, they were classified as 'other.' A tally was created for each category and when a study was found to have included a certain age/race, they were given a check. Populations were considered as included in articles if they presented results or described methods targeting that demographic. Sample sizes for population characteristics were not abstracted as such all studies were weighted equally. Articles that did not present any demographic characteristics were categorized as 'unspecified' in the results tables.

Level of policy or program refers to the institution that created the policy or program; government (e.g, district, city, county, state or federal government agencies); organization (e.g., schools, worksites, faith-based organizations, hospitals, health care centers, non-profits or community based organizations); research institutions (e.g., universities or medical centers); and industry (e.g., food producers, manufacturers, or retailers). Differences in extraction were resolved through discussions between the reviewers.

Results are presented overall and then by the strategy of the dietary policy, program, or intervention that paper was described. When describing characteristics of study populations, papers could fall into multiple categories (e.g., present data on both whites and Hispanics; include children, adolescents, and adults). Hence, as these categories are not mutually exclusive, percentages do not add up to 100%. Additionally, some papers are included in multiple categories. The data was then imported into STATA for tabulation.

3. Results

A total of 2463 articles were identified: 2317 through the PubMed search, and an additional 146 through citation searches (including four grey literature papers). After removing 43 duplicates, 2420 remained for title and abstract screening. The full texts of the 703 papers that met the criteria in the first round of screening were then reviewed. In total, 489 were selected as relevant.

3.1. Overall description

Policies or programs implemented in schools were the most frequently published strategy (31%). Many papers described economic incentives (19%) and local environmental changes (17%). Workplace interventions were the least frequently described (3%) (Fig. 1). The majority of papers discussed policies and programs that were created by the government (39%), followed by research institutions (26%), organizations (26%), and the food industry (9%) (Fig. 2). Policies and programs were most frequently created at the federal level (48%), followed by state (19%), city (16%), district (10%) and county (8%) levels. Three quarters of the papers (75%) included information about age. Of papers that reported on age, over half included children (54%). Many included adults (46%) and adolescents (42%) but only 9% included older adults (Fig. 3a). Race/ethnicity was specified in over half of the published papers (57%). Of papers that reported race/ethnicity data, about three quarters included Whites (77%), Blacks (76%), and Hispanics (70%). Fewer studies examined AI/AN (12%) and NH/PI (8%) (Fig. 3b).

Dietary policies and programs were published about most often from 2013 to 2016, with variability in the frequency of appearance in the literature based on strategy (Fig. 4). School-based strategies were the most popular over time, and publishing on this topic peaked in 2013 (n = 30) (Fig. 4). Economic incentives peaked in 2009, when the greatest number of papers were published on this strategy (n = 6). Literature describing mass media and education campaigns were published most frequently from 2013 to 2016 (range of 12 to 15 studies). Restrictions and mandates were published most frequently during 2009 (n = 6). Literature on food labeling was published most frequently in
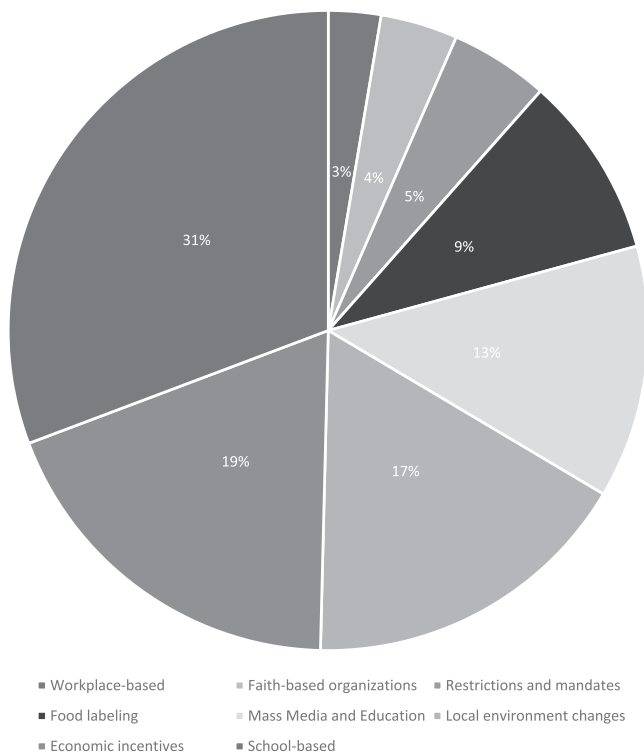
Fig. 1. Frequency of dietary programs, policies and interventions strategies represented in the literature. There were 641 interventions represented in 489 articles.
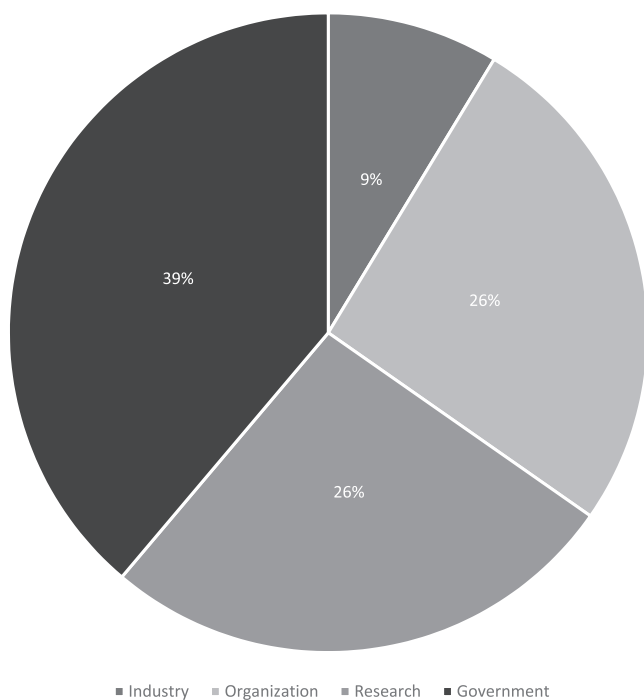

Fig. 2. Frequency of implementing agency. Total number of implementing agencies is the denominator. There were 703 implementing agencies mentioned in 489 articles.

2015 (n = 14). Faith-based strategies were published most frequently in 2013 and 2015 (n = 5). Workplace strategies were published most frequently in 2016 (n = 4).

3.2. School-based

School-based strategies have included community gardening, healthy vending machines and stores, educational modules and cooking classes, and increased availability of clean water (D'Adamo et al., 2016; Eagle et al., 2013; Feenstra and Ohmart, 2012; Schwartz et al., 2016; Schwartz, 2017). Federal school lunch and other government sponsored food programs (Breakfast in the Classroom, Fresh Fruit and Vegetable Program) were also examples of school-based initiatives (Schwartz et al., 2015; Bartlett et al., 2013). School-based interventions appear to have varying efficacy based on the components. They found that singular initiatives, like school gardening programs, were less effective in behavior change compared to multicomponent initiatives, like those combining environmental changes in the cafeteria and economic incentives (e.g., making fruits and vegetables freely available) (Mozaffarian et al., 2012).

Almost all of the papers (91%) published on school-based strategy reported age information. Of all of the papers, the majority of studies included children (78%), most included adolescents (56%), whereas few included adults (7%) and older adults (4%) (Table 1). Race data was also available in the majority of papers (60%). Most of the literature was focused on White (54%), Hispanic (50%) and Black (46%) participants; less papers included Asian (25%), AI/AN (11%) and NH/PI (8%) participants.

3.3. Economic incentives

Economic incentives to foster dietary behavior change have taken the form of taxes on sugary drinks and high-fat, high-sugar products and subsidies to fruits and vegetables (Pomeranz, 2015; Cradock et al., 2015; Hua et al., 2017; Zenk et al., 2014; Di Noia et al., 2017; Basch et al., 2013; DeFosset et al., 2017; Block et al., 2010; Falbe et al., 2016; Gortmaker et al., 2015). Government-sponsored nutrition programs, Supplemental Nutrition Assistance Program (SNAP) and Special Supplemental Nutrition Program for Women, Infants and Children (WIC), which provide benefits to lower-income individuals also have encouraged modification of dietary behavior (Fisher, 2016; Gordon et al., 2017; Pomeranz and Chriqui, 2015; Whaley et al., 2012; Tester et al., 2016, Olsho et al., 2016; Steele-Adjognon and Weatherspoon, 2017; Jilcott Pitts et al., 2015; Lieff et al., 2017; Okeke et al., 2017). Across studies, there is strong evidence in favor of economic incentives, particularly subsidies to lower prices of healthy foods and taxes to increase the prices of less healthful foods (Mozaffarian et al., 2012; Afshin et al., 2015; Fisher, 2016).

Most papers (64%) reported age data. Over half (55%) included adults, fewer reported on children (15%), adolescents (15%) and older adults (12%) (Table 1). More than half (56%) of papers included race/ethnicity data. Most studies included Blacks (46%), Whites (43%), and Hispanics (39%), whereas fewer included AI/AN (4%) and NH/PI (3%) (Table 2).

3.4. Local environment changes

Local environment changes have focused on the built, external environment, as well as the interior architecture of food retailers. Policies have focused on increasing supermarkets and grocery stores and restricting the number of new convenience stores and fast food restaurants (Sturm and Cohen, 2009; Richardson et al., 2017; Elbel et al., 2015). Other programs, farmers markets, community supported agriculture (CSA), mobile produce markets (MPMs) and community gardens, have also been used to improve the food environment and prompt dietary changes (McCormack et al., 2010; Jilcott Pitts et al., 2017; Gans et al., 2016; Leone et al., 2018; Li et al., 2014; Zepeda et al., 2014; Hsiao et al., 2018). Food stores have restricted unhealthy foods in checkout aisles, dedicated more shelf space to healthy food items, installed cooler sections for produce, displayed signs identifying healthy
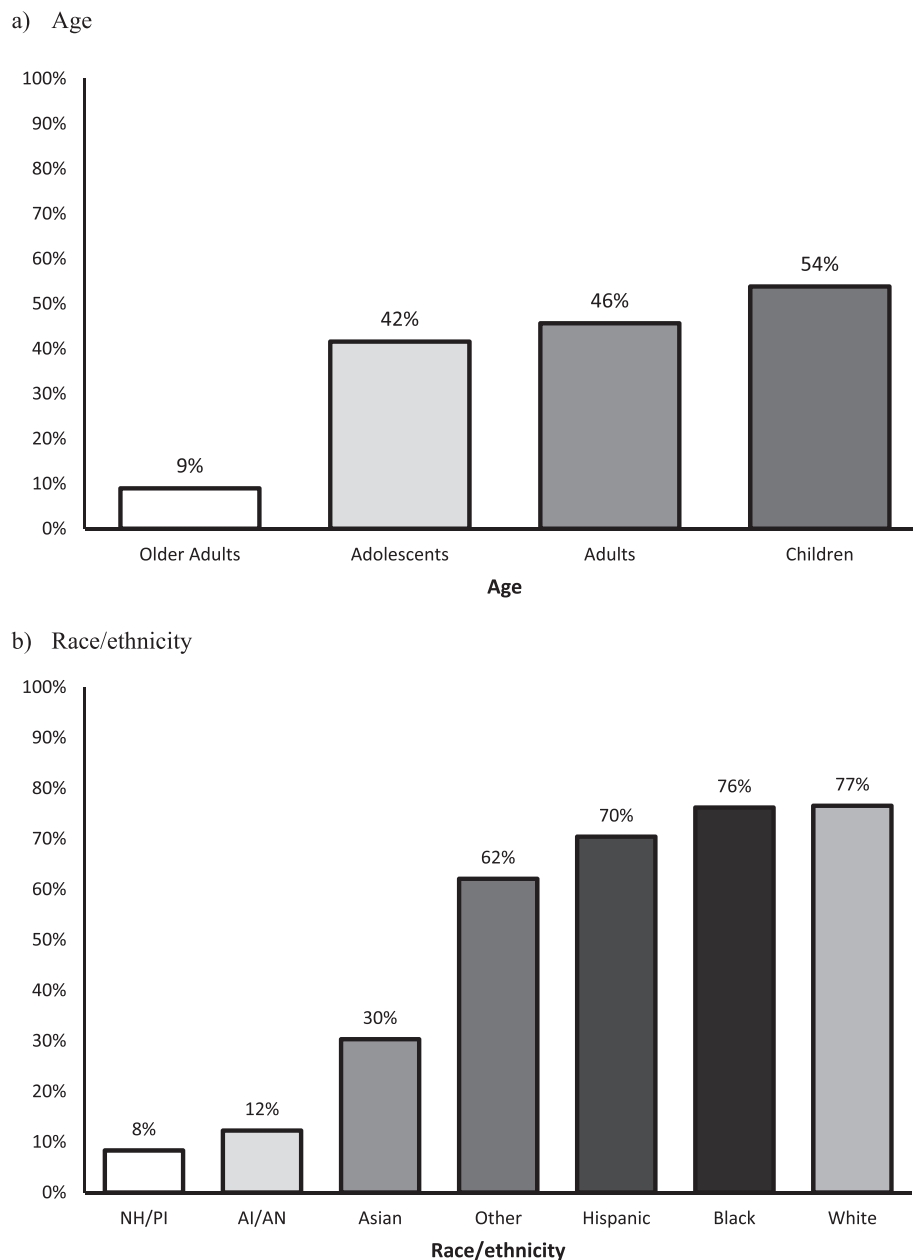
a) Age

b) Race/ethnicity

Fig. 3. Frequency of articles reporting study population characteristics in dietary programs, policies and interventions, among those specifying study population characteristics. a) Age. b) Race/ethnicity.

foods, and offered sample shopping lists to help promote healthier diets (Milliron et al., 2012; Adjoian et al., 2017; Overcash et al., 2018; Torrence et al., 2018). There is mixed evidence supporting environmental changes (Mozaffarian et al., 2012; Afshin et al., 2015; Fisher, 2016). Current evidence for environmental changes on diet appears to remain limited despite the popularity and appeal of this strategy (Afshin et al., 2015).

The majority of papers (59%) included age data. Most reported on adults (46%), followed by children (18%), adolescents (14%) and older adults (8%) (Table 1). Race information was specified in more than half of the papers (56%). Most papers reported data on Blacks (42%), Hispanics (36%), Whites (31%). Fewer papers included Asians (11%), AI/AN (7%) and NH/PI (2%) (Table 2).

3.5. Mass media and education campaigns

Mass-media campaigns and nutrition education efforts have

disseminated information about health effects associated with certain dietary patterns (e.g., fast food and other food-away-from-home) and food products (e.g., SSBs) (Huang et al., 2018). Campaigns have promoted specific healthier foods or warned against less healthful foods, targeted the whole population or focused on specific populations (Huang et al., 2018; George et al., 2016). Posters placed on public transit, libraries, clinics, billboards and community bulletins have accompanied videos and digital messages on websites, social media and TV. Packets and toolkits have also been used to provide information and tips on how to make healthy behavior changes (Fisher, 2016; Huang et al., 2018; Boles et al., 2014; Schwartz et al., 2017). Evidence supporting mass media and education campaigns appears mixed. In isolation, the effects of this strategy appears limited. However, when used in combination with other strategies, there is more data supporting the effectiveness of mass media and education (Mozaffarian et al., 2012; Afshin et al., 2015; Fisher, 2016).

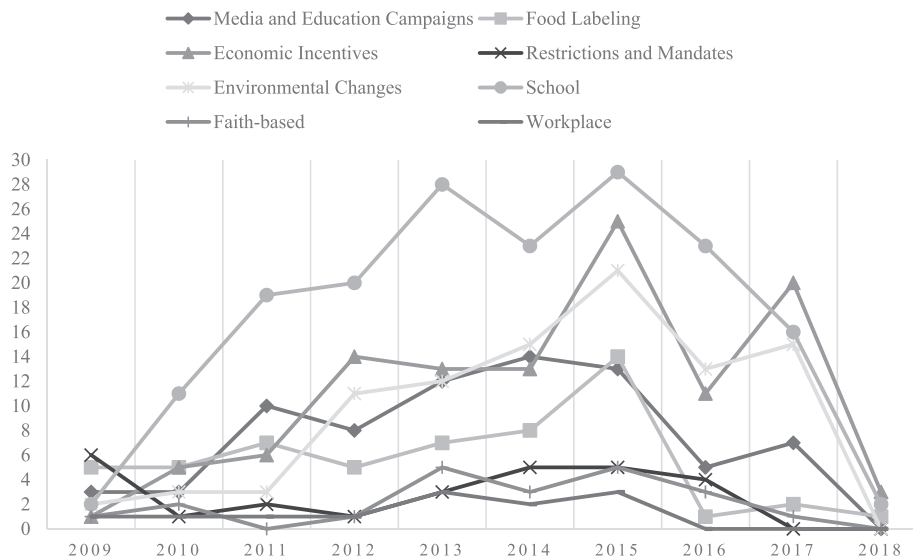Over three-quarters of papers published on mass media and

Fig. 4. Counts of studies by strategy published over time. * Search conducted in October 2018 – number of studies in 2018 were underestimated.

Table 1
Ages represented in papers by policy, program or intervention strategy.

	School-based		Economic Incentives		Environmental changes		Media and Education		Food Labeling		Restrictions and mandates		Faith-based		Workplace-based	
	n	%†	n	%†	n	%†	n	%†	n	%†	n	%†	n	%†	n	%†
Children	153	78%	18	15%	19	18%	12	15%	19	18%	15	46%	1	4%	0	0%
Adolescents	111	56%	18	15%	15	14%	11	13%	15	14%	14	44%	1	4%	0	0%
Adults	13	7%	66	55%	50	46%	55	67%	50	46%	1	3%	21	84%	8	53%
Older adults	7	4%	14	12%	9	8%	6	7%	9	8%	0	0	2	8%	1	6%
Not specified	17	8%	44	36%	44	41%	20	24%	44	41%	16	50%	4	16%	8	47%
Total	197		121		108		82		59		32		25		17	

*Percentages do not add up to 100% as categories are not mutually exclusive. Denominators are the total number of studies within each category.
† % represents percentage of total studies, including those that specified demographics and those that did not.

education campaigns included age data (76%). Most reported on strategies that affected adults (67%), followed by children (15%), adolescents (13%) and older adults (7%) (Table 1). Race information was available in the majority of the papers (63%). Many papers included Blacks (40%), Whites (39%) and Hispanics (39%). Fewer papers included NH/PI (9%) and AI/AN (5%) (Table 2).

3.6. Food labeling

Since the passage of the Nutrition Labeling and Education Act in the 1990s, (Roberto et al., 2009) food labeling has taken many forms: 1)

nutrition fact panels, 2) nutrient content claims, 3) health-related claims (characterizing the relationship between food and risk of a disease), 4) logos based on nutrition standard ("heart check" or "Whole Grain" stamp) and 5) evaluative or grading system (e.g. "traffic light," "Guiding Star") ((US) IoM, 2010; Mozaffarian et al., 2013; Brown, 2011). Moreover, menu labeling has also recently become popular, aided by the Patient Protection and Affordable Care Act of 2010 (ACA), which requires chain restaurants to label calories of menu items and list the suggested daily calories (Long et al., 2015). There is mixed evidence on the effectiveness of food labeling campaigns. Menu labeling for sodium and front of package labels have led to modest reductions (Afshin

Table 2
Races represented in papers by policy, program or intervention strategy.

	School-based		Economic Incentives		Environmental changes		Media and Education		Food Labeling		Restrictions and mandates		Faith-based		Workplace-based	
	n	%†	n	%†	n	%†	n	%†	n	%†	n	%†	n	%†	n	%†
White	106	54%	53	44%	33	31%	32	39%	9	15%	6	19%	8	32%	6	24%
Black	90	46%	56	46%	45	42%	33	40%	8	14%	6	19%	18	72%	4	16%
Hispanic	99	50%	47	39%	39	36%	32	39%	8	14%	6	19%	3	12%	3	12%
Asian	49	25%	14	12%	12	11%	12	15%	5	8%	1	3%	1	4%	1	4%
NH/PI	15	8%	4	3%	2	2%	4	5%	0	0%	0	0%	0	0%	0	0%
AI/AN	22	11%	5	4%	8	7%	7	9%	0	0%	0	0%	0	0%	0	0%
Other	79	40%	52	43%	36	33%	25	30%	7	12%	4	13%	4	16%	5	20%
Not specified	79	40%	53	44%	48	44%	30	37%	46	78%	24	75%	3	12%	10	40%
Total	197		121		108		82		59		32		25		17	

*Percentages do not add up to 100% as categories are not mutually exclusive. Denominators are the total number of studies within each category.
† % represents percentage of total studies, including those that specified demographics and those that did not.

et al., 2015). Some studies have found there is an indirect effectiveness of food labeling in that it has on the food industry to prompt reformulation, in the case of trans fats (Mozaffarian et al., 2012).

More than one-third (36%) of food labelling papers contained age data. Among food labelling papers, 33% included adults, 12% adolescents, 8% children, and 10% older adults (Table 1). Less than a quarter (22%) of papers had race information available. More papers included Whites (15%), Blacks (14%), and Hispanics (14%) than Asians (8%), NH/PI and AI/AN; the latter two groups were not included in any papers (Table 2).

3.7. Regulations, restrictions and mandates

Regulations, mandates, and restrictions have been industry, organization, or government efforts to regulate food advertising, marketing, or product formulation (Roberto et al., 2009; Long et al., 2015; Laquatra et al., 2015; Niederdeppe and Frosch, 2009; Harris et al., 2015; Wilde, 2009; Harris et al., 2013; Schermbeck and Powell, 2015; Harris and Munsell, 2015; Ng and Popkin, 2014; Ng et al., 2014; Mueller et al., 2017). There is consistent strong evidence for regulations. Restrictions on TV advertising of unhealthy foods and beverages to youth have been found to influence dietary preferences but less evidence has been shown for the effects of advertising on other media (Mozaffarian et al., 2012; Afshin et al., 2015). In one of the aforementioned reviews, reformulation was also strongly supported. A combination of quasi-experimental and ecological studies suggest reformulation of products has positive benefits on dietary behaviors (Mozaffarian et al., 2012).

Half (50%) of papers published on restrictions and mandates reported ages of study participants or target population of the strategies. Most papers included children (46%) and adolescents (44%), only one included adults (3%), and none included older adults (Table 1). Only one-quarter (25%) of papers had race information available. The literature included Whites, Blacks, and Hispanics in equal proportion (19%), whereas Asians were less represented (3%) and NH/PI and AI/AN were not represented (0%) (Table 2).

3.8. Faith-based

Religious organizations have served as the source of interventions and support for persons looking to adapt healthier lifestyles. Formal religious structures such as churches, synagogues, and mosques as well as informal religious meetings such as bible studies and prayer groups have promoted nutritious dietary changes in their message and through their mission (Wilcox et al., 2018; Bowen et al., 2009). Despite the limited number of studies, there has been consistent evidence for positive behavior changes attributed to initiatives in faith-based settings (Mozaffarian et al., 2012).

Almost all of the papers published on faith-based strategies had age information available (84%). All of the studies with age information available included adults (84% of total studies), two included older adults (8%) and one included children and adolescents (4%) (Table 1). Race data was also specified in almost all of the papers (88%). The majority of papers included Blacks (72%), with fewer including Whites (32%), Hispanics (12%), and Asians (4%), and none including AI/AN and NH/PI (Table 2).

3.9. Workplace-based

Worksites have aimed to improve the food environment through various policy and program changes including free fruit and/or vegetable delivery services, stocking vending machines with healthy alternatives, decreasing the prices of healthy options in the workplace, healthy meeting and farm to work practices, nutrition and food procurement standards, and cafeteria menu labeling (Backman et al., 2011; French et al., 2010; Lillehoj et al., 2015; Onufrak et al., 2016; Gardner

et al., 2014; Lankford et al., 2013). Employer incentivized wellness interventions have also been implemented to encourage employees to meet certain health goals (Baicker et al., 2010; Fernandes et al., 2018). There is mixed evidence for workplace-based strategies. Labeling in worksite cafeterias or vending machines have had little effect on diet, whereas combined approaches with environmental changes have had more positive effects (Mozaffarian et al., 2012; Afshin et al., 2015).

Half of the papers including workplace strategies reported age data (53%). Most included adults (53%), and one included older adults (6%) (Table 1). Race was included in less than one-third of papers (28%). More papers included Whites (24%), Blacks (16%), and Hispanics (12%) than Asians (4%). No studies included AI/AN or NH/PI (Table 2).

4. Discussion

The present study aimed to identify trends in focus areas and populations that have understudied or not targeted by dietary policies and programs in the United States in the past ten years to inform future research. Many of the papers identified in the literature used interventions that combined multiple strategies. Overall, school-based and economic incentives appear to be the most popular strategies, whereas workplace and faith-based organization policies and programs are less popular. The government was involved in many of the policies and programs, often at the federal level. A deeper review by strategy revealed that many regulations were industry-sponsored. Youth, including adolescents and children, appear to be the primary population studied. AI/AN and NH/PI were not well represented across all types of policies and programs.

Though most papers included children and adolescents in their study samples, there were some differences in ages studied based on strategy type. Few papers describing strategies that might impact children, adolescent or older adults studied these populations; for example, literature on economic incentives, media and education campaigns, food labeling, environmental changes, faith-based organization policies focused primarily on adults. On the other hand, restrictions and mandates primarily were studied among children and adolescents. Many current restrictions and mandates in the U.S. are self-regulatory pledges by the food and beverage industry to limit marketing to youth, which may explain why most papers on this topic included children and adolescents. Additionally, population-wide policies are easier to implement in schools, particularly public schools that are government supported. Studying dietary programs and policies in youth is imperative for multiple reasons, including the rising rates of obesity over the past decade (Ogden et al., 2015), and the importance of establishing healthy dietary patterns and eating habits early in life as a preventative measure (Mikkila et al., 2009; Daniels et al., 2011; Shrestha, 2015). Future research that addresses some of these understudied strategies in children and adolescents would further our understanding of reaching these groups.

We found that few papers included older adults; only 7% of published studies included older adults, with a range of 4% to 8% depending on strategy. Currently, older adults comprise 15% of the US population (Aging Ao, 2017). This population is expected to grow dramatically, so that by 2034, there will be more people living over the age of 65 than under the age of 18 (Bureau, 2018). Additionally, these individuals continue to have increasing life expectancy. In 2016, people age 65 had an additional 19.4 years of life expectancy (Aging Ao, 2017). Though increasing, less attention has been paid towards preventive medicine in older adults (Andrawes et al., 2005). Middle-aged adults aged 40–59 have the highest prevalence of obesity (42.8%) followed by older adults aged 60 and over (41.0%) (Ogden et al., 2015). CVD deaths are highest among the older age group, adults aged 65 and older (CDC/NCHS, 2016). Healthy dietary behaviors among older adults are associated with better cardiovascular outcomes, and that switching to the Mediterranean diet has been associated with lower cardiovascular disease mortality (Andrawes et al., 2005). This evidence

suggests that CVD prevention is effective in older adults. These populations should be included in future research and initiatives.

AI/AN and NH/PI were not studied in some of the strategies in the literature - AI/AN and NH/PI were not included in any studies of food labeling, restrictions and mandates, and faith-based policies. Many papers included an 'other' race category. AI/AN and NH/PI may have been included, but small sample sizes may have dissuaded authors from presenting disaggregated data. Whites, Hispanics, and Asians were included less frequently in faith-based studies, and NH/PI and AI/AN were not included at all. In workplace policies and programs, most papers included Whites in the samples, whereas none included Asians, NH/PI and AI/AN. To ensure policies and programs have an equitable impact on dietary behaviors and health, strategies should be studied in diverse populations. Specifically, additional efforts are needed in racial minority populations AI/AN, NH/PI and Asians across strategies, and among Whites and Hispanics in faith-based strategies.

Black and Hispanics are often recognized as carrying a high burden of obesity, yet, AI/AN and NH/PI have similarly high prevalence (Blackwell, 2018). Though Asians have a lower prevalence of obesity, they tend to have similar risks of hypertension, diabetes and CVD as other groups at lower thresholds of BMI (Shih et al., 2014; Yi et al., 2016; Wong et al., 2014) – therefore current definitions of obesity may underestimate the true underlying risks in Asians (World Health Organization, 2004; Hsu et al., 2015; Kumanyika and Grier, 2006). Further, not all Asian subgroups are similarly affected. Filipinos are 70% more likely to be obese compared to the overall Asian population (CDC, 2008), and South Asians are at particularly high risk for heart disease (Volgman et al., 2018). Deaths attributed to heart disease are similarly high among Asians, including NHPI, and AI/AN compared to Hispanics, non-Hispanic whites, and non-Hispanic blacks (CDC/NCHS, 2016). Though CVD and related conditions are comparable and sometimes higher among AI/AN and NH/PI, these populations are overlooked in dietary program and policy research. Efforts should be made to target these populations to determine the efficacy of these strategies and present disaggregated data, given the differences disease burden among subgroups of Asian populations.

Working with community-based organizations that have deep knowledge about these population can help recruit or target populations that are understudied. Community-based participatory research (CBPR) has shown promise in developing research partnerships with groups that have been historically underrepresented in research (Mehrotra and Wagner, 2018). Particularly for minority and aging populations, which are groups that we identified as being understudied in dietary policy and programs research. In addition to involving community partners in research to identify and better recruit individuals, future policy and program research could be improved by increasing research conducted in "real world" settings (Yi et al., 2020). Less research has focused on the unintended consequences of dietary programs and policies or feasibility in low-resource settings. Understanding the costs and sustainability of policies and programs is also important and often overlooked. More recent publications have suggested combinations of systems science, implementation science and community-based participatory research to better understand the underlying causes of health disparities and address some of the prior limitations of identified above (Frerichs et al., 2016; Jeffries et al., 2019).

Though some were government enforced, many of the regulations and restrictions identified in the literature were industry-sponsored and self-regulatory. Despite industry pledges to restrict marketing to children and reduce calories in products, research has demonstrated that children are continuously exposed to unhealthy food advertisements on television and the energy content of products have not significantly declined (Harris et al., 2015, 2013; Ng and Popkin, 2014). More research is needed into how best to hold the industry accountable for these promises and what interventions other agencies might undertake to mediate the effects of unmet pledges.

Though the aim of this paper was not to discuss the relative

effectiveness of interventions, we included comprehensive reviews that did have that goal. From reviews on the efficacy of individual strategies, we surmised that economic incentives had the strongest evidence-base supporting effectiveness. Evidence also strongly backed regulatory policies, which included reformulation or bans on specific food items. However, overall, multi-component initiatives, which combined two or more strategies, were found to be the most effective at changing dietary behaviors.

There were some limitations to this project. A limitation to our analytical approach was not accounting for differences in sample sizes and sampling methods. Studies with nationally representative sampling were weighted equally to studies with convenience samples of local population. As such, percentages of studies with demographic characteristics should be interpreted with caution and not as population percentages. Due to this limitation, we are unable to determine whether certain groups are well represented in the research in relation to how they are represented in the US population but only the extent to which they have been studied in the past. The systematic search for papers was conducted only on one online database, PubMed. Searches on other databases may have returned additional articles that were not available in the database that we used. Though the majority of included literature came from peer-reviewed journals, a number of included reviews published in peer-reviewed journals assessed grey literature. Still, a more extensive search method (i.e., additional online searches to supplement citation searches) for grey literature may have given a broader understanding of policies and programs in the U.S. Another limitation was that exclusion criteria were not recorded for full-text exclusions, as many papers had multiple reasons for exclusion, and thus could not be reported in the PRISMA flow chart. Despite the rise of obesity and related health conditions, the number of papers published on dietary policies and programs in the U.S. has declined in recent years. It is important to note that the number of papers published is not indicative of the number of policies and programs established in these years. While evaluations of these recent policies and programs are needed to create a strong evidence-base for decision-making, newly adopted initiatives take time to be evaluated and have methodology described. As we included peer-reviewed literature in the trend analysis, we caution against using the year published as a proxy for year implemented. The decrease may also in part be a result from the methodology of the search strategy. Searches were conducted in October 2018, as such papers published at the end of 2018 were not captured. Additionally, a more in-depth search into grey literature may have revealed additional relevant articles on U.S. food policies and programs in recent years and on different topics. Particularly, workplace interventions may appear more so in grey literature than peer-reviewed journals.

5. Conclusions

School-based and youth targeted changes appear to be the most frequent focus of the existing literature describing dietary policies and programs and rather neglects older adults. The anticipated growth in the older adult population size and increase in life expectancy indicates that research into dietary prevention of cardiovascular disease prevention among older adults is imperative. Future research should also focus on increased targeting of specific racial/ethnic subgroups (e.g., Mexicans, Indo-Caribbean Blacks, Chinese) to maximize representativeness and health equity.

Author contributions

RR and SC conducted the search and abstracted data. RR analyzed the data with contribution from YL and SY. RR drafted the manuscript with help from YL, SY, DS, CTS.

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2020.101135.

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