

A Hierarchy of Unhealthy Food Promotion Effects: Identifying Methodological Approaches and Knowledge Gaps

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We assessed the evidence for a conceptual “hierarchy of effects” of marketing, to guide understanding of the relationship between children’s exposure to unhealthy food marketing and poor diets and overweight, and drive the research agenda. We reviewed studies assessing the impact of food promotions on children from MEDLINE, Web of Science, ABI Inform, World Health Organization library database, and The Gray Literature Report. We included articles published in English from 2009 to 2013, with earlier articles from a 2009 systematic review. We grouped articles by outcome of exposure and assessed outcomes within a framework depicting a hierarchy of effects of marketing exposures. Evidence supports a logical sequence of effects linking food promotions to individual-level weight outcomes. Future studies should demonstrate the sustained effects of marketing exposure, and exploit variations in exposures to assess differences in outcomes longitudinally. (*Am J Public Health*. 2015;105:e86–e95. doi:10.2105/AJPH.2014.302476)

Systematic reviews have shown that food marketing has an effect on children’s food preferences and consumption.^{1,2} The lack of evidence directly linking food marketing to children’s weight has proved a barrier to policymakers introducing legislation to limit this practice.³ Food companies would not invest so heavily in marketing to children and in lobbying against legislation to limit marketing⁴ if this did not increase product sales. Nevertheless, evidence is needed to define the mechanisms that underpin marketing’s influence on children’s weight, and the magnitude of these effects.

The argument supporting the need to regulate children’s exposure to unhealthy food marketing hinges on 3 pieces of evidence: (1) food marketing not only encourages brand switching within a product category but also attracts new consumers to the broad food group, (2) the majority of promoted foods are energy-dense and nutrient-poor (“unhealthy”), and (3) consumption of promoted foods contributes to excess energy intake that is not compensated for, leading to weight gain and diet-related disease.⁴

Recent and complex theories recognize marketing as one form of socialization agent that transmits norms, attitudes, motivations,

and behaviors to the learner.^{5,6} Social and learning theories posit that exposure to positive media messages cues children to want portrayed products and to model observed behaviors.^{5,7} Importantly, these theories suggest that such effects can occur even in the absence of conscious perception of marketing stimuli.⁶ Less prominent elements of marketing, and the emotions that are evoked, may be stored in memory and individuals may not consciously acknowledge or believe that a promotion has affected them when it has.⁸

The effect of promotions on children’s weight outcomes can be explained by a cascade of effects in which exposure to promotions influences children’s brand awareness, preferences, and consequently their purchases and consumption,⁹ similar to the hierarchy of effects underpinning social marketing.¹⁰ Earlier systematic reviews on this topic have variously grouped these outcomes of exposure as potential determinants of behavior (preferences, attitudes, knowledge, beliefs), effects on behavior (purchase, purchase requests, consumption patterns), and diet-related health outcomes (e.g., body weight)¹¹; or as mediators of diet (preferences, beliefs, purchase requests), diet (short-term consumption, usual dietary intake), and diet-related health outcomes.² In

marketing literature, the relationship between brand awareness and consumption is referred to as “brand equity.”¹² Brand equity is achieved when a brand is highly recognizable and associated with positive attributes.¹² With this review, we aimed to outline a conceptual pathway of effects of how marketing may ultimately influence children’s weight. We also sought to collate information on methods used to measure the impact of food promotions on different levels of effects. Within the term “marketing,”¹³ this review specifically focused on food advertising, sponsorships, and sales promotions (collectively referred to as promotions).

METHODS

We undertook a narrative review of studies assessing the impact of food promotions on children. We did not seek to quantify the magnitude of effects of promotions. Rather, the focus was to identify methodological approaches to inform further development of policy-relevant research. We identified peer-reviewed articles from MEDLINE, Web of Science, ABI Inform, World Health Organization library database, and The Gray Literature Report. Search terms included (food OR beverage) AND (marketing OR advertising OR promotion) AND child*. The search was restricted to English-language articles published from 2009 to 2013, with earlier articles captured from the bibliography of a relevant systematic review of studies from 1970 to 2008.¹

Included papers measured the impact of promotions on attitudinal or behavioral responses, or health-related outcomes in children. Excluded studies comprised those that assessed the impact of promotions on adults, although we included surveys measuring adults’ perceptions of promotional effects on children. Other excluded studies were those that only described the extent of children’s exposure to promotions, marketing policies,

social marketing campaigns, or links between television and food behavior or overweight in general. The link between television viewing and diet and weight has been well documented.¹⁴ We scanned articles for relevance and grouped them by outcomes of exposure, and linked them in a sequential way according to a cascade of effects model. This model was conceptualized on the basis of the groupings of literature on food marketing effects outlined in previous systematic reviews and noted previously^{2,11} and related social and learning theories.

RESULTS

Figure 1 provides a conceptual pathway of effects of promotions (which we refer to as a “logic model”). It incorporates arguments referred to previously, that exposure to promotions results in food category as well as brand switching, and that there is no

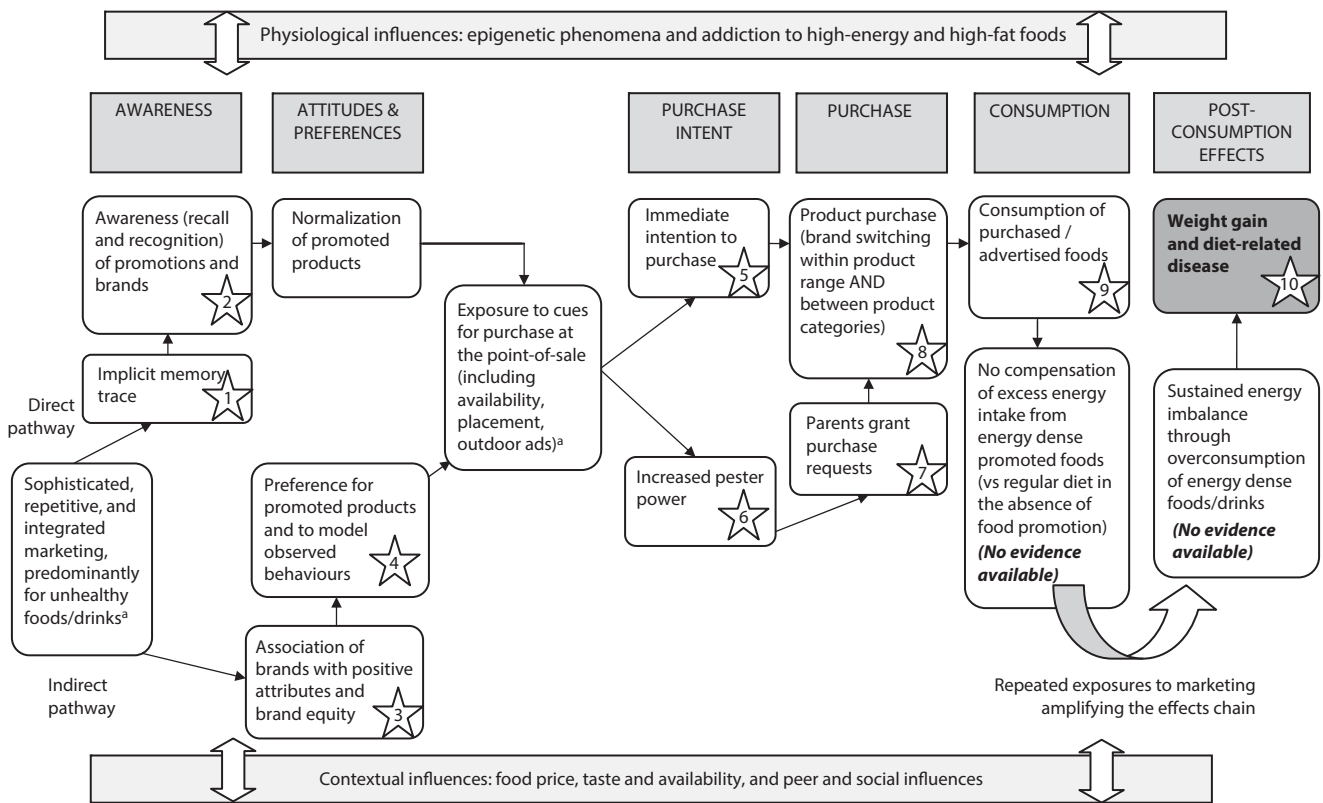
compensation for excess energy intake following consumption of promoted foods. It also considers the behavior and learning theories outlined previously, as well as the outcomes assessed in available literature. We noted the role of other contextual factors within the broader food and social environment of individuals in influencing food preferences and choice, and also the role of epigenetics in later pathophysiological responses to obesogenic diets,¹⁵ and evolutionary processes that prime individuals to prefer foods or beverages high in energy and fat.¹⁶ These latter influences are not referred to specifically throughout this review, but should be considered as part of a more complex system influencing food choice and behavior. Epigenetic and evolutionary influences also suggest that the proposed framework may not simply be extrapolated to the promotion of healthy (low-fat, low-energy) foods. Of course, food marketing is only one

environmental determinant of obesity, and this framework should be considered in the context of the myriad other individual, social, and environmental influences.¹⁷

The following sections describe the methods used to assess each link in the hypothetical logic model, with a summary of study designs and measures provided in Table 1. Table 1 can be cross-referenced to Figure 1 by using the numbered star symbols, which represent outcomes where studies are available.

Awareness

The first step in the logic model is the impact of promotions on unconscious brand memory. Memory tracing refers to the storage of information after exposure (to promotions).⁶¹ This memory trace influences later responses to promotion exposures for the same brand, such that these are recognized and more deeply processed.⁶¹ Memory tracing can be



Note. Stars indicate that studies are available to assess response indicators (see Table 1).
^aAssessed in studies measuring extent and nature of exposure to marketing.

FIGURE 1—Logic model of unhealthy food promotion effects, from narrative review of studies assessing the impact of food promotions on children: 1970–2013.

TABLE 1—Approaches to Measuring Components of the Food Marketing Logic Model From Narrative Review of Studies Assessing the Impact of Food Promotions on Children: 1970–2013

Marketing Exposure Outcomes in Figure 1 (Star No.) ^a and Study Designs to Assess Outcomes of Marketing Exposure	Examples of Measures Assessed	Examples of Measurement Indicators
Implicit memory trace (1)		
Stroop tests	Naming of different foods labeled with congruent and incongruent words ¹⁸	Amount of time taken to correctly name the food item
RCTs	Food choice following re-exposure to a food promotion (priming) or nonfood promotion after previous exposure to the media containing the food promotion ¹⁹	Choice of product for those in the food promotion (current exposure) vs nonfood promotion test conditions, comparing those with previous exposure (implicit memory) or no previous exposure
Awareness of promotions and frequently promoted brands (2)		
Word- or brand-association tests	Matching pictures of brand logos and food products, ^{20,21} or logos and sporting organizations ²²	No. of correct associations between brands and products, or sports and sponsoring brands
Cross-sectional surveys	Verbal recall of sponsors of local sports club and sponsors of favorite elite sports team or person ²³	No. of correctly recalled food company sponsors
Association of brands with positive attributes and brand equity (3): cross-sectional surveys	Attitudes to foods or brands by using semantic differential scales before and after short-term exposure to food promotions ²⁴ or in relation to sponsors of their favorite sport ²³	Ratings of healthy and unhealthy foods or different brands combined to give attitude scores; baseline scores compared with frequency of TV viewing and after exposure to food promotion
Desire for promoted products (preferences) and to model observed behaviors (4)		
Cross-sectional surveys	Reported factors that influence food choices, including food promotions ^{25,26}	Ranking of promotions as a factor influencing food choices
RCTs	Reported preference for a food product or type of food from a range of products after short-term exposure to a food promotion: comparison conditions have included food or neutral or nonfood promotion ^{24,27-29} ; high exposure to food promotion, low exposure to food promotion, or no promotion ³⁰ ; or healthy or unhealthy promotions ³¹	Frequency of preferences for snack types or changes to product liking after exposure to different test conditions
	Ratings of “liking” of a series of identical foods ^{32,33} or healthy and unhealthy foods ³⁴ with and without promotions or branding on packaging; can include tasting of foods before rating ^{35,36}	Overall attitude score or taste preference score for liking of foods with promotions or branding vs liking of foods without promotions or branding
Immediate intention to purchase (5): RCTs (choice trials)	Selection of snacks (healthy, unhealthy but not advertised, or unhealthy and advertised) after short-term exposure to food promotion; control group viewed media with no promotion ³⁷	Difference in snack selection by test condition
	Selection of healthy vs unhealthy snacks following sustained exposure to food promotion; test conditions included unhealthy food promotion, healthy food promotion, nonfood promotion or no promotion ³⁸	Difference in snack selection by test condition
Increased pester power and changes to household purchases (6)		
Cross-sectional surveys	Parent agreement with statements about the impact of food promotions on their own and other children’s purchase requests and eating habits ³⁹⁻⁴¹	Proportion agreeing with statements and frequency of purchase requests
Cross-sectional surveys	No. of h of TV viewing per d and reported purchase behaviors and requests for advertised foods ⁴²	Frequency of purchase requests compared with no. of h of TV watched per d
Qualitative focus groups	Advertising messages enjoyed by children and the extent that children requested advertised products ⁴³	Thematic analysis of the role of ads in influencing purchase requests
RCTs	Reported intentions to request products after short-term exposure to promotions on packages; test conditions included familiar character, unfamiliar character, or no character ⁴⁴	Intended purchase requests for snacks compared by test condition and snack type

Continued

TABLE 1—Continued

Parents grant purchase requests (7); covert observational studies of point-of-purchase interactions	Frequency of child requests for products and frequency of parent purchases of requested products ⁴⁵	Proportion of requested products that were purchased
Product purchase (brand switching within product range and between categories; 8)		
Cross-sectional surveys	Agreement with statements about the impact of food promotions on food purchases and consumption ²³	Proportion agreeing with statements
Modeling studies linking purchases and information on product promotions	Household purchases of child-targeted foods for products advertised on TV and those not advertised on TV ⁴⁶	Differences in volume of advertised products purchased vs nonadvertised products purchased
Ecological experiments	Household purchases of fast-food meals for households where advertising ban was in place vs another city with no advertising ban ⁴⁷	Differences in no. of fast-food meals purchased by households in cities with and without advertising bans
Consumption of purchased or advertised foods (9)		
Cross-sectional surveys	Reported recent exposure to different promotion types and consumption of advertised products ⁴⁸ ; also, frequency of consumption of unhealthy snack types and amount of TV watched per d	Associations between exposure to food promotions and trialing of advertised foods; association between the amount of TV watched per d and frequency of intake of unhealthy snacks
RCTs (choice trials)	Consumption of healthy vs unhealthy snacks following short-term exposure to a food promotion: test conditions included food or neutral or nonfood promotion ^{49,50} ; unhealthy food promotion, healthy food promotion, nonfood promotion, or no promotion ^{7,51,52} ; or familiar character, unfamiliar character, or no character ²⁸	Differences in energy intake or gram weight of food consumed from snacks overall, or from unhealthy and healthy snacks, by test condition
	Amount of energy or food consumed at a buffet or meal with branded foods vs a buffet or meal with foods in plain packaging ^{18,53}	Differences in energy intake or gram weight of food consumed for branded vs unbranded buffets or meals
Modeling studies linking dietary intake data and information on exposure to promotions	Reported frequency of intake of unhealthy foods and previous exposure to promotions for these foods based on industry data on advertising patterns ^{9,54}	Change in intake of promoted unhealthy foods with increasing ad exposure
	Reported frequency of intake of sugar-sweetened beverages at school compared with presence of pouring rights at school ⁵⁵	Difference in energy intake from sugar-sweetened beverages between children in schools with and without pouring rights (exclusivity arrangements, where companies are the sole product category provider)
Econometric studies	Annual ad expenditures for soft drinks and their consumption ⁵⁶	Association between increasing ad expenditure and consumption over time
Weight gain (10)		
Modeling studies linking data on obesity prevalence and advertising patterns	Published data on obesity prevalence and extent of exposure to TV advertising from 1 or multiple countries; estimate of effect of advertising on weight gain based on published data or expert opinion ^{57,58}	Proportion of obesity attributable to exposure to advertising based on exposure patterns
Longitudinal studies	Measured data on height and weight and previous exposure to promotions for unhealthy foods based on industry data on advertising patterns ⁵⁹	Change in weight status with increasing exposure to unhealthy food promotions.
	Repeat measures of commercial and noncommercial TV exposure and BMI ⁶⁰	Change in BMI z scores for every additional h of commercial TV watched per d vs additional noncommercial TV watched

Note. BMI = body mass index, defined as weight in kilograms divided by the square of height in meters; RCT = randomized controlled trial.

^aParenthetical numbers correspond to the star number in Figure 1, and citations in "Examples of Measures Assessed" correspond to the matching star numbers in the figure.

assessed with the Stroop cognitive processing test.¹⁸ This traditional association test has been modified, so that the time taken to correctly state food pictures or logos in response to associated words was measured as an indicator of attentional bias toward brands.¹⁸ Brand

logos shown with a congruent label would be processed more quickly than logos with an incongruent label, and children who have memory (both implicit and explicit) of promotions would process this information more slowly than children without previous

exposure, because of greater cognitive interference.¹⁸ Alternatively, implicit memory has been studied in the United Kingdom following children's exposure to the placement of Pepsi in a movie, when children were not consciously aware of the product, but where this increased

their choice of Pepsi over Coca-Cola, compared with a control group.¹⁹

Brand recall was assessed by asking children about brand awareness, and recognition was measured by using association tasks, akin to the concept of word associations. For example, studies have asked children to recall food sponsors of their favorite sports,²³ or to match pictures of brand logos with food types.^{20,21} An Australian study required children to link elite sporting teams to alcohol and fast-food brands, and health campaigns that had been promoted alongside the sports.²² Among children aged 5 to 12 years ($n=164$), three quarters correctly matched at least 1 sport to 1 of its sponsors, and this matching was higher for children's favorite sports.²² It is possible, but unlikely, that elicited associations between brands and sports were attributable to random matching. The more combinations there are to be made, the lower the likelihood that correct associations will be the result of random placement.²²

Attitudes and Preferences

Studies have explored the effect of promotions on food and brand attitudes through child surveys by using semantic differential scales.^{23,24} An Australian study randomized children ($n=858$) to view either unhealthy or healthy food advertisements, within a television program.²⁴ Children rated foods along scales representing adjective antonyms, before and after promotion exposure. Changes in ratings of healthy and unhealthy foods did not differ between conditions. The impact of episodic exposure to promotions may be difficult to detect, as control-group children would have similar baseline levels of marketing exposure. However, greater commercial television viewing was associated with positive attitudes toward unhealthy foods.²⁴ Cumulative exposure to promotions is likely to have a greater impact on food attitudes than a single episode.

Food preferences may arise through exposure to promotions, and taste and consumption experiences.⁶² Exposure to promotions can influence perceived taste, particularly when foods have not previously been tried.⁶³ Researchers assessing the influence of promotions on food preferences have asked children to consider factors that influence their liking of foods.^{25,26} In a US study of children aged 9 to

11 years ($n=218$), the presence of cartoon characters on labels for fruit and vegetables was rated as unimportant in influencing liking of these foods, compared with factors such as taste.²⁵ However, questioning children about influences of food preferences is inherently flawed, as responses to promotions are not necessarily conscious.

Experimental trials have measured food preferences after episodic exposure to promotions. Children exposed to unhealthy food promotions are more likely to report preferring related unhealthy foods, than unexposed children.^{29,30} Researchers in the United Kingdom showed children aged 6 to 13 years ($n=281$) nonfood or food advertisements, with a 2-week interval between conditions.²⁹ Exposure to food advertisements led children to prefer more of the foods, including branded foods not depicted in the advertisements.²⁹

In a Spanish study, children aged 11 years or older ($n=405$) played an online game either with branding for M&M confectionery or with no branding.³⁰ Compared with baseline, children who played the M&M-branded game increased their preferences for M&Ms.³⁰ This study used naturalistic gaming conditions, whereby test games were placed on a gaming Web site. A US study assessed the impact of packaging on preferences, whereby children aged 3 to 5 years ($n=63$) rated foods with McDonald's logos as preferable to unlabeled identical foods.³⁶ This effect was consistent for unhealthy and healthy foods. Precautions were taken to ensure that children were not influenced by nonverbal interviewer cues, with a screen placed between children and interviewers.

Cartoon characters serve as brand identifiers and contribute to the development of brand personalities.³³ Evidence indicates that children prefer foods displaying promotional characters.³³⁻³⁵ In these studies, children are often presented with packages with or without characters and asked to rate their preferences, sometimes following taste testing. In one US study, which presented identical product pairs to children, one of which displayed a licensed character, children perceived the foods with characters to taste better than those in plain packaging.³⁵ Preferences were only determined within product categories (e.g., savory snacks), and the impact of characters on

broader food category preferences cannot be identified. Other studies have shown that children choose less healthy snacks without characters in preference to healthy snacks with characters,^{28,34} and that the effect of characters on preferences is only significant when the brand is unfamiliar.³⁴ This highlights the need to use nonmarket brands for testing of packaging effects, to isolate the impact of these attributes from existing brand equity.

Premium offers also influence food preferences. In a US survey with children aged 3 to 5 years ($n=85$), children were shown picture cards of "meal deals" under 3 conditions: with a noncollectable toy, with a collectable toy, and with no premium.³² The presence of a collectable toy, which completed a set provided to children, increased preference for the healthy meal, such that this was equal to ratings of the unhealthy meal when paired with the collectable toy.³² In the absence of this toy, children preferred the unhealthy meal.³² There was little effect of the premium on ratings of the unhealthy food, as children's attitudes toward this product were high regardless of the toy, reflecting previous experiences of the food or promotions.

Tools to assess food preferences must be validated against actual food selection to ensure that they are indicative of food choice behaviors.⁴⁹ Measures of food preference can be susceptible to demand effects, whereby children select responses they perceive to be "correct" or desired (the healthy choice). In 1 UK experiment that assessed consumption of foods displayed with and without licensed characters, reported preferences were only weakly associated with the type and amount of food subsequently consumed.²⁸

Purchase Intent

Purchase intent refers to the prediction that a child (or the child's parents) may buy a product in the near future. Studies that measure purchase intent measure children's own food selections from a virtual or actual choice set, or their reported purchase requests to parents. Changes to purchase intent can be assessed after short-term³⁷ or sustained⁵⁷ marketing exposures. One early Canadian study that addressed limitations of the short-term nature of many experimental trials and the impact of extra-experimental influences was conducted

within a 2-week camp, where children were exposed to controlled advertising and snacks.³⁸ In this study, children aged 5 to 8 years (n = 288) who were exposed to 5 minutes of television advertisements for confectionery daily selected less fruit as a snack, compared with children who saw advertisements for fruit, public service announcements to limit sugar, or no advertisements.³⁸

Cross-sectional surveys with children⁴² and parents^{39–41} have determined reported frequency of purchase requests. A UK survey asked parents (n = 145) about children's in-store food purchase requests and perceived influence of packaging.⁴⁰ More than half of parents agreed that their children tried to influence purchases.⁴⁰ Parent reports may be subject to social desirability bias, with parents in this study reporting a low frequency of granting requests, compared with observational studies of supermarket parent-child interactions.^{45,64} Other studies have used qualitative methods to identify the extent that children requested promoted foods.⁴³

Purchase

Surveys have asked children about agreement with statements related to product purchases.²³ In an Australian survey of 103 children aged 10 to 14 years, two thirds agreed that "other children bought food/drink products because these companies sponsored their sport."²³

Commercial sales data are often difficult to obtain, but studies have collected sales data at the household level.⁴⁶ One study compared data on household purchases and children's exposure to promotions to determine the volume of advertised versus nonadvertised foods purchased.⁴⁶ In this US study, barcodes of breakfast cereals purchased were scanned by participants over 1 year.⁴⁶ Cereal purchases were compared with the frequency of television cereal advertisements. For child-targeted cereals, the median number of buyers for advertised cereals was 13-fold higher than nonadvertised products.⁴⁶ Data on actual product purchases provides an objective measure. However, nonadvertised products may be manufactured by smaller companies with lower in-store availability, which would confound the relationship between promotions and purchases.

An ecological study assessed purchases of fast food in jurisdictions with and without marketing restrictions.⁴⁷ Data on fast-food expenditure were compared between French- and English-speaking households in Quebec and Ontario. A ban on advertising to children has been in place in Quebec since 1980, although this only applies to channels originating from this province, which are predominately French-speaking. Other English-language channels are broadcast into Quebec from neighboring areas. French-speaking households with children in Quebec were less likely to purchase fast food compared with similar households in Ontario.⁴⁷ Differences in purchases between English-speaking households in these provinces were not significant, nor was there an effect on French-speaking Quebec households without children.⁴⁷ This study overcomes limitations of laboratory-based experiments, which have less external validity.

Consumption

Most studies in this domain have assessed the effects of promotions on immediate changes to food consumption. In a trial with 270 Dutch children, exposure to online games promoting confectionery resulted in increased intake of energy-dense snacks following the game, compared with children who played a game with nonfood brands, or no game.⁵¹ However, children who played a game promoting fruit had a similar intake of energy-dense foods.⁵¹ These unexpected findings may indicate that exposure to any food may cue an increased intake of energy-dense snacks. Alternatively, it may indicate that controlled experiments are limited in their ability to detect changes to short-term food consumption because of pre-existing preferences. Another study from the United States that investigated the impact of branded games on children's food consumption found that those who played a game with healthy food branding consumed more healthy foods and less unhealthy foods following gameplay.⁶⁵ As expected, the opposite consumption pattern was found for those in the unhealthy branding condition.

A series of studies by UK researchers assessed the impact of episodic exposure to television food advertising on short-term intake.^{49,66,67} In one trial, in which children aged 9 to 11 years (n = 42) were exposed to food

and nonfood advertisements and later asked to recall the advertisements and then consume snacks *ad libitum*, those with higher advertisement awareness consumed more food.⁴⁹ Similarly in the United States, a trial with children aged 7 to 11 years (n = 108) exposed children to either food or nonfood advertisements embedded in a cartoon program, and they were provided with a snack (nonadvertised crackers) while watching.⁷ Children in the food advertising condition ate considerably more crackers than those in the nonfood condition.⁷

Laboratory-based studies are limited to controlled settings, and findings may not be translatable to usual contexts. Some studies attempted to overcome this by introducing naturalized settings, or "living room" laboratories for viewing television.^{50,52} To control for effects of time of day and previous food consumption, children were asked to rate their pretest hunger and liking of test foods.^{50–52} Similarities in test groups' snack-eating behaviors at baseline were also assessed.⁵⁰

Other studies have identified associations between cumulative promotion exposures and longer-term food consumption.^{9,48,54,56} In the United States, the association between television advertisement exposure and consumption of sugar-sweetened beverages and fast food was assessed by comparing intake of these items by 9760 children aged approximately 11 years.⁵⁴ Industry data on exposure to advertisements (gross rating points) over 3 years were collected, reflecting the proportion of the target audience reached by advertising.⁵⁴ Exposure to soft drink advertisements was associated with increased intakes of soft drinks and fast food.⁵⁴

Another study compared Dutch children's exposure (n = 234) to food advertisements and food intake over 4 days.⁹ Advertising exposure was based on reported popular television channels and advertising frequency on these channels during the preceding month. Food advertising exposure accounted for 4% of the variance in consumption of advertised brands.⁹ However, analyses did not consider the number of hours of television watched, and exposure was based on only the most popular channel for each child.

An Australian survey of 12 188 secondary-school children assessed associations between reported exposure to commercial television

and number of premium offers seen on non-broadcast media in the past month and eating behaviors.⁴⁸ A dose–response relationship was identified for the number of hours of commercial television watched and intake of commonly advertised foods.⁴⁸ Children reporting higher exposures to premium offers were more likely to have requested or tried advertised foods.⁴⁸ The dose–response relationship supports a more likely causal relationship between promotion exposure and food consumption. The true impact is likely to have been underestimated, as only recalled exposures were assessed.

Econometric studies have examined the extent to which marketing expenditure is associated with food consumption.⁵⁵ Associations between expenditure on soft drink marketing and consumption by 10- to 19-year-olds in the United States were estimated from industry data from 1984 to 2007.⁵⁵ No association was identified between expenditure and consumption; however, increases in population size and price of soft drinks were likely confounders and were not controlled for in the modeling.

In some studies, children’s weight status has a differentiating effect on reactions to food promotions. In a US trial ($n = 43$), overweight children consumed 40 kilocalories more when food was presented in branded packages versus when presented in unbranded packages, and nonoverweight children consumed 45 kilocalories less in the branded package condition.⁵³ However, this difference by weight status has not been consistently observed.⁷

Weight Outcomes

Few studies have compared differences in exposure to commercial television and weight longitudinally.^{59,60} These studies are difficult, as weight gain typically occurs gradually and there is limited variability in marketing exposures between children within the same culture, with most children exposed to high volumes of promotions. A US study compared exposure to commercial and noncommercial television and weight outcomes in 2037 children aged 0 to 13 years at baseline.⁶⁰ Each hour of commercial television that children (< 7 years) watched per day in 1997 was associated with a 0.1 increase in body mass index (BMI; defined as weight in kilograms divided by the square of height in meters)

z score in 2002.⁶⁰ There was no association between noncommercial television and weight.⁶⁰ This study design controlled for reverse causality, where children with higher BMIs watch more television. By delineating commercial and noncommercial television, the discrete effects of advertising could be determined.

Chou and others assessed the likelihood of overweight for children aged 3 to 18 years based on 2 US longitudinal surveys that included questions on television viewing and anthropometry.⁵⁹ These data were compared with industry information on fast-food advertising exposures, based on place of residence. The authors estimated that a ban on fast-food advertising would reduce overweight prevalence by 14% to 18%,⁵⁹ a conservative estimate as only local channels were considered. Analyses controlled for regional variables that would increase fast-food intake, including fast-food restaurant availability. In a cross-sectional survey of 10 countries, data on television food advertising frequency were correlated with local data on childhood obesity prevalence.⁶⁸ A significant correlation was identified between frequency of television advertising for unhealthy foods and obesity prevalence. However, no measure of children’s actual exposure to television food advertising was included and other potential confounding factors were not addressed.

Other studies have used modeling to predict the impact of advertising on weight.^{57,58} Data from the US National Health and Nutrition Examination Survey on children’s television viewing and food consumption were compared with published literature (1 study from 1983) to quantify the relationship between advertising and obesity.⁵⁸ An estimated 4.5% reduction in energy intake would occur if food advertising exposure reduced from 80.5 minutes per week to nothing.⁵⁸ The study also included a Delphi survey, which generated higher estimates of advertising impact; however, these estimates are less convincing as they were based on expert opinion.

DISCUSSION

This review highlights methods for studying the impact of food marketing on children with

reference to a hypothetical logic model. The framework represents proposed links between attitudinal and behavioral responses to marketing, and weight outcomes. Reviewed studies support this framework, and provide a basis for synthesizing evidence linking marketing to health by providing evidence of the impact of marketing sequentially along each of the hierarchy levels. The studies identify how marketing can operate directly, by influencing brand awareness, and indirectly by influencing brand attitudes. Positive affect toward brands is then reinforced when point-of-purchase cues are available.⁴ Consumption of promoted foods becomes harmful if these foods differ in nutritional quality from foods otherwise consumed, and if this leads to sustained overconsumption of energy and risk-related nutrients.

Although the hypothetical effects model is depicted as a linear progression, it is likely that many of the levels are recurrent and result in positive feedback and reinforcement of earlier levels. For example, consumption of a product may lead to positive attitudes toward a brand, especially where this is consumed in particular social settings or occasions. The true causal chain linking food marketing exposure to postconsumption effects may be more complex. Nevertheless, this model presents a way of examining this association in a systematic way. Such models are useful for understanding the dimensions of, and interrelationships between, factors contributing to “wicked” or complex problems.⁶⁹

This model builds on other frameworks that have been used to systematically arrange literature on food marketing effects, including the 5-element causal framework used in an Institute of Medicine review on this topic, which outlines a series of mediators (e.g., food beliefs, preferences, requests) and moderators (e.g., age) in the relationship between food marketing and diet-related health outcomes.² The proposed model provides a more detailed representation of these mediators in this relationship and their interrelationships. The model is also aligned to marketing communications theory, which shows consumers moving from cognition to affect to behavior following exposure to marketing messages.⁷⁰ However, marketing communications theory does not expressly take into account moderators and mediators in this relationship between

food marketing exposures and behavior, unlike the proposed model.

The proposed model is not intended to be tested by using mediational analyses as it is not a causal model. Rather it is a hypothetical framework for which evidence is required to demonstrate that each of the steps is operating. Importantly, this model discredits the notion of a simple, direct link between food marketing exposure and obesity. Although we only considered studies that assessed the impact of marketing on children in this review, there is little reason to suppose that this framework could not also be applied to older ages, and especially to young adults. Indeed, it appears that awareness of food branding increases with age among children,^{20,21} and evidence from sponsorship literature demonstrates that adults have high brand awareness of sport sponsors and this awareness is associated with greater intentions to consume sponsor's products, compared with those with low awareness of sponsorship arrangements.⁷¹⁻⁷³

This review collated information on methods used to assess marketing effects at each level of the logic model. Key elements of methodologies considered were the study approaches and study measures used and the media studied. Each has merits and limitations in terms of its usefulness in adding strength to the evidence base for the relationships postulated by the model.

Study Approaches

Experimental trials have typically assessed the impact of single exposures to 1 form of promotion. A range of factors may interfere with study outcomes, including children's preference for the test food, previous accumulated marketing exposures, and, in the case of trials assessing food consumption, time of day of the testing, earlier food intake, and weight status. Laboratory-based trials cannot reasonably account for the cumulative effects of exposure, the permanence of effects over the longer term, and the impact of integrated campaigns that span multiple media. Longer-term experimental trials are difficult, as these would require altering children's usual media exposure. Although this is possible for a limited set of media (e.g., excluding television advertisements through recording devices), the general ubiquity of promotions means that children

would remain exposed to marketing elsewhere. Experimental studies have also failed to determine if differences in food consumption after exposure to promotions are compensated for at later eating occasions.

Cross-sectional studies that exploit variations in children's marketing exposures are useful to highlight potential differences in dietary or weight outcomes. However, correlational studies risk making spurious assumptions unless careful adjustment for confounders is performed. Higher television viewing may reflect an underlying passive lifestyle or a clustering of less-healthy behaviors. Other moderators in the relationship between food promotion and attitudinal or behavioral responses include maternal weight concerns,⁵² media literacy,⁷⁴ and covieing of television with parents.⁷⁵

Study Measures and Media Studied

Appropriate study measures should consider the cognitive abilities of children and avoid reading or writing tasks. For example, children's performance in brand recognition tasks does not seem to be determined by age, with picture-matching tasks easily navigated by young children.²⁰ However, children aged 5 years and younger perform less well at brand-recall tasks.⁵³ Most studies assessing food or brand preferences used Likert scales depicting smiley faces suitable for younger children. To identify the impact of specific promotional techniques, mock brands should be used to eliminate preexisting conceptions about market products.³² Combining quantitative and qualitative measures can enable a better understanding of children's attitudes toward food promotions and their effects.

Most studies measuring the effect of marketing have used television advertising or packaging, with some using online games. Although no data were available on other new forms of marketing, including social media, these could have a greater impact. Peers are recognized as agents of children's socialization.⁷⁶ Viral communication of commercial messages through social media may contribute to peer-group acceptance and sharing of products.

Recommendations for Future Studies

Future studies should aim to build the links between marketing exposure and outcomes along each of the steps of the effects chain. In

particular, there is a need for further evidence at the more distal end of the framework, which measures the impact on behavior and weight outcomes. To establish causality, studies should seek to eliminate the possibility of reverse causality and confounding. Establishing a dose-response relationship between marketing exposure and impacts would also contribute evidence to causality arguments.^{48,60} Furthermore, studies should assess the sustained effect of marketing exposure on food choices and behaviors, including whether any overconsumption of promoted foods is compensated for at later eating occasions. Although evidence suggests that children may have an innate ability for caloric compensation, this mechanism is less effective in overweight children and it is possible that this is interrupted by external cues to eat, including from food marketing.⁷⁷ Natural experiments are useful, such as the comparison of food behaviors between children exposed to varied food marketing as a result of policy interventions.⁴⁷

Measures of intentions to purchase or consume foods are limited and cannot, by themselves, predict actual behaviors. However, in the assessment of health behavior change, behavioral intention is seen to be a necessary condition for actual change,⁷⁸ which has relevance here. Measures of behavioral intention should be triangulated with parent reports or other more objective observational measures of food purchase and consumption. Greater measurement precision for exposure to marketing and outcomes of exposure are required. Finally, research should assess the impact of promotions that use new media, and the impact of media mix.

Conclusions

Despite methodological challenges, there is a considerable body of evidence that supports a sequenced set of effects linking food promotion exposure to intermediate outcomes, such as children's attitudes and behaviors, and, finally, to weight-related outcomes. This research spans multiple disciplines, including marketing, psychology, and public health. This analysis clarifies the quality of the current evidence base, and helps to dispel expectations that a single study could demonstrate direct links between marketing and weight, when in fact there are numerous intermediate outcomes

that accumulate over time and across multiple marketing exposures. Any single episode of exposure may have small individual effects, and each contributes in a small way to reinforcing a cascade of effects.

The limitations of laboratory research, and the range of variables operating in real-world research, need to be considered. As a consequence, definitive evidence coupling marketing and weight may be unattainable. Nevertheless, this review and framework demonstrate the plausibility of marketing and health associations through a series of linked intraindividual steps. This information can guide research synthesis and interpretation of findings, and inform evidence-based policy. The next generation of research should determine the longer-term impact of marketing exposure on dietary behaviors and weight, and the effects of repeated exposures, including integrated marketing. ■

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Contributors

B. Kelly conceptualized the logic model, retrieved and appraised papers, and drafted the article. L. King conceptualized the logic model, appraised papers, and contributed to the development and refinement of the article. K. Chapman, E. Boyland, A. E. Bauman, and L. A. Baur provided input into the logic model and critically revised the article.

Human Participant Protection

This study did not require ethical approval because no human participants were involved.

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