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A macro-level assessment of introducing children food advertising restrictions on children's unhealthy food cognitions and behaviors

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ABSTRACT

Numerous studies have highlighted the undesirable effects of food advertising on children across the world. However, very few researchers have looked at the impact of food advertising restrictions on the targeted outcomes of these policies. This paper presents three studies that assessed the impact of child food advertising restrictions in Singapore. The studies include (1) a content analysis of television advertisements, (2) a door-to-door household pantry survey of families, and (3) a large-scale survey of school children. Results indicate that the amount of unhealthy food advertising has declined since the policy implementation, children's cognition about fast- food have shifted desirably, household stocks of a number of unhealthy foods have decreased slightly, and children's self-reported consumption of unhealthy foods has decreased slightly. Age and gender effects were found, where older children, and girls, show larger differences. Implications for policy and future research are discussed.

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Introduction

Childhood is a period where many food consumption preferences and habits are formed, potentially leading to the development and persistence of overweight and obesity throughout an individual's entire lifetime (Nicklaus et al. 2004; Birch 1999; Freedman et al. 2005; Kelder et al. 1994). Through the use of attractive images and psychological priming, food advertising is widely acknowledged to affect children's food consumption choices, leading to habits and preferences that are detrimental to their health (Dixon et al. 2007; Bickham et al. 2013; Powell, Szczypka, and Chaloupka 2007; Boyland and Halford 2013; Buijzen, Schuurman, and Bomhof 2008). In response, there are increasing calls from the scholarly community, as well as humanitarian

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organizations, to regulate food advertising to children (Kelly et al. 2010; World Health Organization 2014). As a result, governments across the world have adopted a wide variety of ways to address these concerns, from statutory approaches to a variety of self-regulatory frameworks with regard to food advertising (Hawkes and Lobstein 2011).

Despite these policy implementations, there is limited empirical evidence about the effectiveness of food advertising regulation. We aim to fill this gap in knowledge by providing an initial assessment of a recent self-regulatory approach to food advertising restrictions in Singapore. This article presents three studies that examined the effects of ratifying a set of self-regulatory guidelines aimed at reducing television food advertisements targeted at children at two time points—pre- and postpolicy implementation. It includes (1) a content analysis that examines the frequency of unhealthy foods advertising targeted at children, (2) a door-to-door survey that examined differences in children's attitude towards unhealthy foods and the amount of unhealthy foods in the household pantry, and (3) a large-scale survey to examine whether children's self-reported consumption of unhealthy foods has decreased after the introduction of the food advertising regulation.

Food advertising effects on children

The notion that food advertising is a significant driver of child unhealthy food consumption behaviors has been studied by advertising scholars for several years (De Jans et al. 2019). This causal relationship has sometimes been referred to as the "*food advertising effects hypothesis,*" which is based on two assumptions: (a) that advertising targeting children consists largely of energy-dense food products, and (b) children exposed to these ads consume a less healthy diet than children who are not exposed (Buijzen, Schuurman, and Bomhof 2008).

The first assumption, that advertising targeting children consists largely of unhealthy food products, is one of the main reasons why many critics have singled out food advertising as a major contributor of childhood obesity (Hastings et al. 2003; Matthews et al. 2004; Hastings et al. 2006). This assumption is supported by several content analyses conducted in a number of countries.

In the United States (US), it has been found that 91% of food ads shown during children television programming on Saturday mornings were for foods high in fat, sodium, with added sugars, or low in nutrients (Batada et al. 2008). In countries as diverse as Australia, Switzerland, Britain, Turkey, China, Spain, Canada, Greece, and New Zealand, similar findings have shown that a large majority television advertising consists of food ads for foods that contribute to an unhealthy diet for children (Keller and Schulz 2011; Lewis and Hill 1998; Hammond, Wyllie, and Casswell 1999; Neville, Thomas, and Bauman 2005; Arnas 2006; Chapman et al. 2006). In Singapore, where our study was conducted, more than half of the food ads screened were for unhealthy foods (Huang, Mehta, and Wong 2012). Overall, the evidence points towards the fact that, globally, foods advertised on television reflect a dietary pattern that is not in line with recommended nutritional guidelines, and can be associated with increased risk of obesity (Boyland and Halford 2013; Kelly et al. 2010).

The second assumption of the food advertising effects hypothesis, that children exposed to food advertising would exhibit unhealthier eating choices, has also been found in several studies. In one study, exposure to soft drink and fast food advertising was found to lead to increased consumption of these food items, as well as being significantly associated with an overweight and obese body mass index (Andreyeva, Kelly, and Harris 2011). In addition, food advertising exposure was found to be associated with having preferential attitude towards consuming junk food (Dixon et al. 2007). Experimental research has likewise found that even short 30-second televised food commercials can have significant effects on children's food preferences (Borzekowski and Robinson 2001). Another study found that the occurrence food brand placement in movies led to children's higher recognition and choice of the presented brand, independent of their ages and familiarity with the presented movie (Naderer, Matthes, and Zeller 2018). These adverse effects are argued to occur across different contexts, with some exceptions (Goris et al. 2010). As a result, researchers have argued that advertising regulations, or bans, are one of the most cost-effective ways to combat obesity (Magnus et al. 2009; Gortmaker et al. 2011, 2015).

Background: regulation on food advertising research

The first law of its kind in banning food advertising to children under 13 was passed in Quebec, Canada in 1980. Under the Quebec Consumer Protection Act, products or programs targeted at children are banned in all forms of media. Despite this, much of the enforcement of the law has been focused on television. As long as more than 15% of a television program's audience are children, advertising which is targeted at children, or both children and adults, are completely restricted from being broadcast. In programs where more than 5% of the audience are children, advertisements (ads) targeting children are banned. Since Quebec, other countries such as the United Kingdom (UK), Norway, Sweden, and Brazil have also passed statutory regulation that restricts advertising to children (Galbraith-Emami and Lobstein 2013; Hawkes and Lobstein 2011; The Economist Intelligence Unit 2017).

For example, in Australia, standards are set by the Australian Communications and Media Authority (ACMA) to ensure that children under 14 years old are protected from the potentially harmful effects of television programming. While industry and government regulations are also in effect, the Children's Television Standards (CTS) is the overriding standard. CTS classifies programs as either for children or preschool children, and it defines the maximum advertising time and repetition of ads for each classification. Under both, promotion of alcohol and any food product that contains misleading or incorrect nutritional value information is strictly prohibited (Australian Communications and Media Authority 2009).

Other than statutory approaches, many countries have opted for self-regulation as a policy response to food advertising effects on children. In Europe, eight of 12 governments with policies addressing food advertising have opted for self-regulation. This reflects the European Union's Audiovisual Media Services Directive's advice to consider self-regulatory approaches first (Hawkes and Lobstein 2011; European Commission 2014).

In Singapore, new regulations have recently been introduced to address the effects of food advertising to children. In a public-private collaboration, the Ministry of Health (MOH), the Health Promotion Board (HPB), Advertising Standards Authority of Singapore (ASAS), Consumers Association of Singapore, Singapore Manufacturing Federation, and Food Industry Asia, developed guidelines that will govern the exposure of children aged 12 years or younger to food and beverage advertising distributed across all media in the country. These guidelines were incorporated into the Singapore Code of Advertising Practice (SCAP), and took effect in January 2015 (Advertising Standards Authority of Singapore 2016). Under it, all food and beverage products primarily promoted to children in any media must meet the nutritional criteria endorsed by the HPB. Marketing communications should also not encourage unhealthy and excessive eating or drinking habits, as well as undermine the role of parents or caregivers as the children's guide in their dietary and lifestyle choices. With regards to television advertising, food products that do not meet the nutritional criteria cannot be advertised during certain hours of the day where child viewership is high (a detailed schedule of these hours can be found in the Singapore Code of Advertising Practice (Advertising Standards Authority of Singapore 2016). For food and beverage ads to be eligible, the products must contain positive components such as fiber and calcium, as well as have limited sodium, saturated fat, and total sugars.

Existing evidence regarding the impact of regulatory policies

Although there is an increasing number of regulatory policies introduced to combat the effects of food advertising on children, there remains a dearth of empirical evidence on the impact of numerous policies that have been instituted globally in the past two decades. Existing studies offer some support for the effectiveness of advertising regulations as a way to protect children from overconsuming unhealthy foods. In Quebec, one study suggested that the ban has led to a 13% decrease in probability of fast food purchases in all surveyed households, with a total estimated reduction of US$88 million spent on fast food (Dhar and Baylis 2011). In the UK, the Office of Communications has found that children's exposure to high fat, salt, and sugary food advertisements decreased by approximately 37% between 2005 and 2009, with the effects being more pronounced among younger children aged between 4 and 9 (Ofcom 2010). In addition to the abovementioned studies on actual advertising regulation, other researchers have attempted to estimate and model the effects of hypothetical advertising bans, estimating that obesity rates of children and adolescents would likely be significantly reduced if a complete ban is enforced (Chou, Rashad, and Grossman 2008).

Theoretical framework

A useful schema for understanding how advertising regulations can impact consumer behavior is Vakratsas and Ambler's (1999) framework of how advertising works. In their framework (see Figure 1), they conceptualized the process of advertising effects as one that involves four steps (Vakratsas and Ambler 1999). First, advertising effects

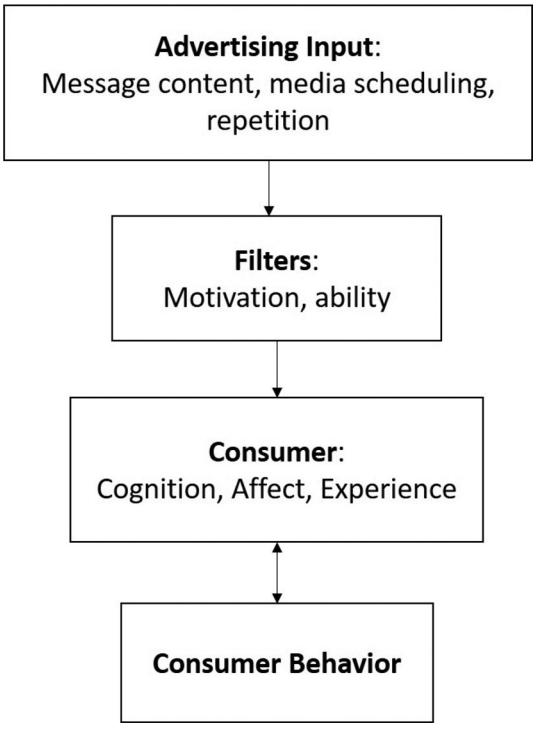

Figure 1. Adapted from Vakratsas and Ambler (1999).

require advertising input—this includes the content of advertisements, their scheduling, and how often consumers are exposed to them. Next, the individual's processing of the advertising message is determined by their motivation and ability to process that information (Petty and Cacioppo 1986). Following the processing of information, it is hypothesized that there would be some form of intermediate effect on a consumer's thoughts and emotions (or attitude) toward a product or a behavior. Finally, these intrapersonal factors are postulated to affect their behavior.

Existing evidence supports such a perspective. First, unhealthy food advertisements represent a large proportion of television commercials. A US-based study conducted just before the implementation of the Children's Food and Beverage Advertising Initiative (CFBAI) self-regulatory program found that food advertisements accounted for nearly half of all commercials shown during children's television programming hours (Stitt and Kunkel 2008). This is similar in Singapore, where the majority of foods advertised involved high-calorie, low-nutrient food products (Huang, Mehta, and Wong 2012). Evidence also suggests that children's exposure to food advertising has the potential to influence their food-related attitudes and subsequent attempts to convince parents to purchase these food products (Coon and Tucker 2002; Hitchings and Moynihan 1998). Other researchers have also found that TV viewing time was directly associated with children's positive attitudes towards the types of foods displayed in advertising content, as well as food choices and eating behavior (Scully et al. 2012; Dixon et al. 2007).

From this perspective, advertising regulation is aimed at reducing advertising input to an individual. Such a reduction is hypothesized to lead to cascading effects in an individual's intermediate thoughts and feelings about various products, and subsequently, their consumption behavior. Existing studies have found that advertising regulations can decrease advertising input, with one particular study suggesting that children's exposure to food advertisements decrease following the introduction of advertising regulations (Ofcom 2010). Reviews of regulatory initiatives from developed countries such as Australia and the U.S. have found that advertising regulations do indeed, to an extent, reduce children's (and the general public's) exposure to unhealthy food advertisements (Powell, Szczypka, and Chaloupka 2010; King et al. 2011). Nevertheless, these studies also highlight that more should be done to standardize industry definitions of unhealthy food products, as a large proportion of the types of foods marketing during children programming are still those high in sugar, sodium, and/or fat (Powell, Szczypka, and Chaloupka 2010; King et al. 2011; Kunkel, Castonguay, and Filer 2015; Powell, Schermbeck, and Chaloupka 2013). Other studies have suggested possible behavioral level changes, with the potential reduction of household spending on fast food, as well as child obesity rates (Dhar and Baylis 2011; Ofcom 2010; Chou, Rashad, and Grossman 2008).

Currently, we know of no other study that has examined the impact of a regulatory policy across multiple stages in the process outlined by Vakratsas and Ambler (1999). Specifically, no studies have sought to examine intermediate effects—how the reduction of fast-food advertising that comes as a result of food advertising regulations can reduce the valence of consumer attitude towards unhealthy foods. Examining the effects of food advertising regulation across these different stages of advertising effects allow us to have a more complete picture of the process in which food advertising regulations impact children.

Based on the theoretical framework and existing evidence as described above, we hypothesize that:

H1: The quantity of unique product advertisements depicting unhealthy foods will be significantly lower after the introduction of the self-regulatory policy compared to before

H2: Children's attitude towards unhealthy foods will be significantly more negative after the introduction of the self-regulatory policy compared to before

H3: Household inventory of unhealthy food products will be significantly lower after the introduction of the self-regulatory policy compared to before

H4: Children's consumption of unhealthy foods will be significantly lower after the introduction of the self-regulatory policy compared to before

Overview of studies

In order to address these research questions, a three-study multi-method, multi-sample approach was taken. Overall, we conducted (1) a content analysis of food ads on three major free-to-air (FTA) television channels, (2) a household survey of families with middle- and high-school children measuring children's attitude towards unhealthy foods and the items in their household pantry, and (3) a large-scale survey

of middle- and high-school children measuring their self-report consumption of unhealthy food, pre- and post-policy implementation. All three studies involved data collection at least 6 months prior to the policy implementation (Phase One), while follow-up studies were conducted at least 6 months after (Phase Two).

In all three studies, ethics approvals were obtained from the university's Institutional Review Board (IRB-2014-12-033), and the Singapore Ministry of Education where necessary, prior to the commencement of each study. Informed consent was also provided to each participant explaining the purpose of the study. In the case of child respondents, informed parental consent and child assent were obtained before data collection. The following section details results from the three sets of studies.

Study one

Method

Study One is a two-phase content analysis designed to understand if the amount of unhealthy food advertising decreased after policy implementation. A set of two-week samples was obtained for three free-to-air channels in two phases in the year 2014 and years 2015–2016. Two weeks is considered as a reasonable length of time to provide sufficient material for advertisement content analysis (Weerakkody 2009). Two free-to-air (FTA) channels, Channels 8 and 5, were selected as they had the highest viewership in Singapore (Mohandas 2015). A third free-to-air channel, Okto, was selected as a complementary FTA channel for assessment, as it is dedicated to children and youth audiences (Media Development Authority 2015).

We interviewed local media providers in order to determine optimal bands for recording. The time-belts chosen for the recordings were 4 PM to 9.30 PM on weekdays (5.5 h), an additional period from 8 AM to 12 PM (4 h) on weekends. The first time-belt was chosen as it straddles the children's belt of 9 AM to 9 PM, as well as the families'/adults belt of 7 PM to 11 PM. The second timeslot was added on for the weekends to include the morning part of the weekend children's primetime of 7 AM to 9 PM. All channels except for Okto in Phase 2 were collected and completed simultaneously, resulting in a total of 279 hours of footage per phase. Due to theft of the recording device containing the Okto footage, a proxy re-recording had to be done later in 2016 to make up for the lost footage.

Following that, we trained two coders to code the footage of the commercials. Advertisements containing consumable products were coded into two different categories: (1) healthy food, (2) fast food restaurants, (3) unhealthy convenience foods, and (4) unhealthy convenience beverages. Healthy food comprises of the product categories of high-fiber cereals, digestives/high-fiber snack bars, fresh fruits and vegetables, 100% fruit juice, dried fruit, and water. Fast food restaurants comprise of all ads for fast food products. Unhealthy convenience foods comprise of the product categories of instant meals, fried/roasted chips and other packaged snacks, cookies/biscuits/crackers/snack bars, high sugar cereals, cakes, candy/gum/chocolate, and breakfast pastry. Unhealthy convenience beverages comprise the categories of sodas/carbonated drinks, non-carbonated sweet drinks, and instant beverages. Intercoder reliability was found to be at 95% overall (Table 1).

Results

In Phase One, unhealthy food products made up 55.10% ($n = 27$) of all unique ads, a trend found to be consistent with previous studies (Huang et al. 2012). In Phase Two, obtained after the implementation of the policy restrictions, the figure dropped to 37.65% ($n = 32$). We conducted a one-tailed z-test for the two proportions with the alpha set at .05, and found that this reduction was statistically significant ($z = 1.96$, $p = .03$), supporting H1. The drop in the number of unique ads came from advertisements promoting fast food restaurants, which saw a reduction from 28.57% ($n = 14$) to 14.12% ($n = 12$) in Phase Two. Healthy food product advertising remained consistently low before (4.08%, $n = 2$) and after (4.71%, $n = 4$) policy implementation. Although unhealthy convenience beverage ads saw a minor drop from 12.24% ($n = 6$) to 8.24% ($n = 7$), unhealthy convenience foods actually saw a minor increase in the number of unique ads after the policy implementation (14.29%, $n = 7$ to 15.29%, $n = 13$). Figure 1 illustrates these differences between the two time points. The findings here suggest that it might be multi-national fast food companies that are adhering more to the self-regulatory guidelines, compared to smaller regional companies that might be responsible for the advertising of unhealthy convenience foods, partially supporting H1.

Study two

Method

Study Two is a household survey designed to understand if children's attitude towards consuming unhealthy foods, as well as the amount of unhealthy foods in the household pantry, has decreased after the policy had been implemented. In this study, participants were recruited through door-to-door interviews using a multi-stage cluster sampling procedure. First, a list of primary and secondary government schools in Singapore was compiled and split into regions as demarcated by the Urban Redevelopment Authority in Singapore. Schools were randomly stratified and selected within each region, with the researchers beginning the process from the housing apartment block with the lowest property number adjacent to the school premises. Data collection started from the smallest numbered unit on the top floor. With each unsuccessful attempt, the researchers skipped one unit to the right. At the end of each floor, the researchers proceeded one level down and repeated the process.

For each participating household, the researchers first surveyed the parent, then the child, and finally the home food inventory. Parents and children each completed a survey questionnaire examining their attitude towards consuming unhealthy foods. Both parent and child surveys were conducted in a common area such as the living room in order to respect the privacy of the household and provide assurance to the parents. To measure the amount of unhealthy foods in each household's pantry, parents were provided with a set of five standardized zip-lock bags and instructed to gauge which bag would best fit the total amount of each food item present in their pantry.

In total, 300 parent-child pairs (M_{age} of parents = 43.90 years, M_{age} of children = 12.34 years) were recruited in Phase One. Participants were contacted via phone

Table 1. Overview of sample.

Phase number	Phase 1 (6 months prior)			Phase 2 (6 months after)		
Channels recorded	Ch. 5	Ch. 8	Okto	Ch. 5	Ch. 8	Okto
Weekday time-belt		4 PM–9.30 PM			4 PM–9.30 PM	
Weekend time-belt		8 AM–12 PM			8 AM–12 PM	
		4 PM–9.30 PM			4 PM–9.30 PM	
Total no. of TV hours processed		279			279	

approximately 12 months later to arrange an appointment for Phase 2 and were compensated $30 for participation in each phase. The final sample size after attrition was 210 parent-child pairs (M_{age} of parents = 44.68 years, M_{age} of children = 13.08 years). Ethnic distribution of the sample (73.0% Chinese, 10.0% Malay, 13.5% Indian, 3.5% other races) closely resembled that of the nation's population (Department of Statistics Singapore, 2018). The breakdown of the gender and age of the child participants is shown in Table 2.

Measures

Attitude towards consuming unhealthy foods was measured using 12 four-point scale items adapted from Aikman, Crites, and Fabrigar (2006) that examined affective factors (positive and negative; 4 items each) and an abstract cognitive qualities factor (3 items). The items were presented below four full-color pictures of unhealthy food items. The Cronbach's α for positive affect (P1: .89, P2: .87), negative affect (P1: .76, P2: .72), and cognitive qualities (P1: .63, P2: .79) were acceptable.

Home food inventory checklist was compiled by asking parent participants to complete a 58-item predefined home food inventory checklist. Items were developed from food checklists used in prior literature on nutrition and obesity studies (Bryant and Stevens 2006; Kremer et al. 2006). Participants responded on each food item using a seven-point scale by selecting a "best fit" size with reference taken from a set of five zip-lock bags (measuring 320 mL, 760 mL, 1290 mL, 3330 mL, and 4800 mL, respectively). Two other options were provided for sizes that did not fit any of the bags: "smaller than 320 mL" (1) and "larger than 4800 mL" (7). Select food items were also combined to represent healthy food and unhealthy food groups. Healthy food is comprised of fruits and vegetables, while unhealthy food includes hotdogs, burgers, pizza, chicken nuggets, crackers, potato chips, corn chips, sweets, and chocolate. The Cronbach's α for healthy food (P1: .68, P2: .77) and unhealthy food (P1: .66, P2: .63) were acceptable. Descriptive statistics for all the items used in the questionnaire are presented in Table 3.

Results

To address H2, we conducted paired samples *t*-test comparing three facets of attitudes towards consuming unhealthy foods between Phase One and Two. The paired samples t-tests indicated that scores for positive affect towards unhealthy food were significantly lower post-policy implementation ($M = 3.38$, $SD = .85$) as compared to pre-policy implementation ($M = 3.56$, $SD = .83$), $t(209) = 2.83$, $p = .005$, $d = .20$). With regard to cognitive attitude towards unhealthy food and negative affect towards unhealthy food, there were no significant differences in pre- and postpolicy implementation.

Table 2. Breakdown of gender, race, and age of child participants.

	n	%
Gender		
Male	114	54.3
Female	96	45.7
Race		
Chinese	152	72.4
Malay	24	11.4
Indian	29	13.8
Others	5	2.4

	Phase 1		Phase 2	
Age	*n*	%	*n*	%
10	40	19.0	2	1.0
11	45	21.4	42	20.0
12	38	18.1	44	21.0
13	39	18.6	39	18.6
14	23	11.0	35	16.7
15	24	11.4	25	11.9
16	1	.5	23	11.0

Table 3. Descriptive statistics of Study 2's measures.

	Phase 1			Phase 2		
	M	*SD*	α/r	*M*	*SD*	α/r
Attitude towards consuming unhealthy food						
Abstract cognitive qualities			.63			.79
1. I consider the above food to be healthy	1.72	0.73		1.61	0.89	
2. I consider the above food to be safe	2.32	0.99		2.25	1.11	
3. I consider the above food to be natural	2.19	0.94		2.04	1.06	
Positive affect			.89			.87
1. I feel happy when I eat the above food.	3.80	0.87		3.60	0.96	
2. I feel comforted when I eat the above food.	3.48	0.96		3.18	1.02	
3. I feel enthusiastic when I eat the above food.	3.39	1.01		3.20	1.01	
4. I feel satisfied when I eat the above food.	3.57	0.98		3.53	0.99	
Negative affect			.76			.72
1. I feel guilty when I eat the above food.	2.70	1.20		2.85	1.09	
2. I feel concerned when I eat the above food.	3.12	1.08		3.11	1.07	
3. I feel bored when I eat the above food.	2.25	0.92		2.33	0.98	
4. I feel uncomfortable when I eat the above food.	2.32	0.90		2.40	1.03	
Home food inventory						
Healthy food						
1. Fruits	4443.14	3097.04		4646.57	3520.23	
2. Vegetables	4998.00	3409.04		4808.76	3682.89	
Unhealthy food						
1. Hotdogs	610.86	1156.10		416.29	916.79	
2. Burgers	108.33	385.42		99.05	459.90	
3. Pizza	356.14	1374.34		307.00	1311.59	
4. Chicken nuggets	1210.10	2246.90		772.90	1700.60	
5. Crackers	1109.33	1697.53		962.62	2168.91	
6. Potato chips	836.29	1799.30		653.00	1614.29	
7. Corn chips	149.14	811.17		111.19	519.01	
8. Sweets	868.10	1635.05		594.52	1588.51	
9. Chocolate	1246.57	1979.89		818.86	1857.06	

These results suggest that H2 was partially supported. Table 4 displays a summary of the paired samples t-tests that were conducted on the cognition variables.

Further analyses revealed some age and gender differences. Significant differences in positive affect between the two phases were found for those aged 13 and above ($t(121) = 2.41$, $p = .017$, $d = .22$), compared to those aged 12 and below. In addition,

Table 4. Paired samples *t*-test results comparing child attitudes toward consuming unhealthy food between phases one and two.

	Paired difference (Phase 1–Phase 2)	*t*	*df*	Sig. (two-tailed)
	Mean			
Pair 1: Unhealthy food cognitive attitude	.10	1.66	209	.099
Pair 2: Unhealthy food positive affect	.18	2.83	209	.005
Pair 3: Unhealthy food negative affect	−.08	−1.44	209	.152

$N = 210$.

significant differences between the two phases for positive affect ($t(95) = 2.21$, $p = .03$, $d = .23$), as well as cognitive attitude ($t(95) = 3.68$, $p < .001$, $d = .38$) were found for girls and not boys.

To address H3, we conducted multiple paired samples *t*-test of home food inventory items between phases one and two. The results indicated that the overall amount of unhealthy food in the pantry inventory was significantly lower post-policy implementation ($M = 526.16$, $SD = 736.11$) as compared to pre-policy implementation ($M = 721.65$, $SD = 806.94$), $t(209) = 3.43$, $p = .001$). No significant differences, however, were found in the amount of healthy food in the household pre- and post-policy implementation. A more fine-grained analysis found that the amount of chicken nuggets were also significantly lower at post-policy implementation ($M = 772.90$, $SD = 1700.60$) as compared to pre-policy implementation ($M = 1210.10$, $SD = 2246.90$), $t(209) = 2.55$, $p = .011$, $d = .18$). In the same vein, the amount of hot dogs were also significantly lower at post-policy implementation ($M = 416.29$, $SD = 916.79$) as compared to pre-policy implementation ($M = 610.86$, $SD = 1156.10$), $t(209) = 2.12$, $p = .035$, $d = .15$). Likewise, the amount of sweets ($M = 594.52$, $SD = 1588.51$) and chocolates ($M = 818.86$, $SD = 1857.06$) at post-policy implementation were significantly lower compared to pre-policy implementation at $M = 868.10$, $SD = 1635.05$, $t(209) = 2.06$, $p = .041$ and $M = 1246.57$, $SD = 1979.89$), $t(209) = 3.05$, $p = .003$, respectively. There were no significant differences in the amount of corn chips, crackers, potato chips, pizza, burgers, vegetables and fruits. Figure 2 summarizes the mean comparison for all the unhealthy food products between phase one and two.

Study three

Method

Study Three is a large-scale cohort survey designed to understand if a selected number of self-reported unhealthy food consumption behaviors of children decreased after the implementation of the food advertising restrictions. In this study, participants were recruited from schools across Singapore. First, 100 schools were randomly selected from the Singapore Ministry of Education's (MOE) list of schools. Following that, survey questionnaires were administered to students that were eligible (Singaporean citizen or Permanent Resident, aged 9–16 years). Participants completed the survey questionnaire in a classroom setting, using pen and paper, and in the presence of a researcher and the teacher-in-charge. Class teachers assisted with the distribution and collection of questionnaires. The entire data collection process lasted about 30 minutes per class. In Phase One, the sampling procedure was used to collect data from 5 primary schools

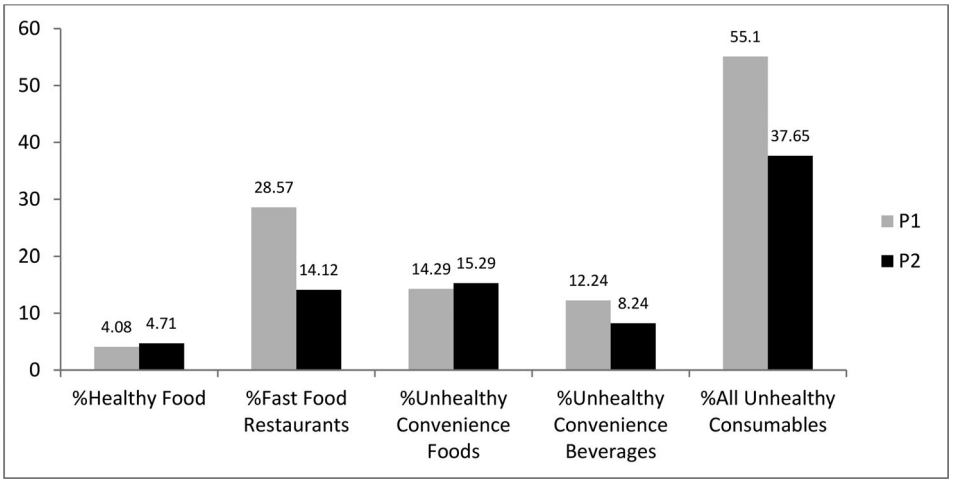

Figure 2. Percentage comparisons between Phase one and two of various categories of unique food and beverage ads.

(i.e. middle) and 2 secondary schools (i.e. high-schools). In Phase Two, the same sampling procedure was used to collect data from 2 primary schools and 3 secondary schools.

In total, 1495 participants (M_{age} = 12 years) were recruited in Phase One. In Phase Two, 1137 participants (M_{age} = 11.4 years) were recruited. Ethnic distribution of the sample in both Phase One (70.6% Chinese, 15.8% Malay, 7% Indian, 5.5% other races) and Phase Two (60.5% Chinese, 23.8% Malay, 7.5% Indian, 6.9% other races) closely resembled that of the nation's population (Ministry of Social and Family Development, 2016). The demographic breakdown of the sample is illustrated in Table 5.

The dependent variables examined in this study were *healthy* and *unhealthy food consumption behavior*, which were measured by asking children how often they consumed a particular food item on three 4-point ordinal scales, anchored on "none" (1) to "everyday" (4). The unhealthy food items include potato chips, burgers and candies.

Results

To address H4, we compared the pre- and post-policy implementation scores for children's self-reported food consumption behavior. Independent sample t-tests were conducted to examine the mean differences between the time periods, gender, and age and the consumption of healthy and unhealthy food. Results are presented in Tables 4–6.

Overall, there is a significant difference in the consumption of potato chips and candies between phase 1 and phase 2 (Table 6).

Independent sample *t*-tests were conducted to examine the mean differences of various food consumption for age (12 and below and 13 to 16 years) and gender. For male students, there were no significant differences in the consumption of both healthy and unhealthy foods between the two time periods. For female students, there were significant differences between the consumption of potato chips and candies. Female students report lower consumption of potato chips (M = 1.88, SD = .67,

Table 5. Breakdown of gender, race, and age of child participants.

	Phase 1		Phase 2	
	n	%	*n*	%
Gender				
Male	765	51.6	566	50.3
Female	718	48.4	559	49.7
Race				
Chinese	1056	71.4	688	61.3
Malay	236	16	271	19.5
Indian	104	7	85	7.3
Others	82	5.5	79	6.2
Age				
10	319	23.1	265	27.6
11	252	18.3	192	20
12	253	18.4	132	13.7
13	272	19.8	201	20.9
14	243	17.6	118	12.3
15	29	2.1	10	1
16	8	0.6	1	0.1

Table 6. Mean scores of health and unhealthy food consumption.

	Phase 1		Phase 2		
	Mean	*SD*	Mean	*SD*	*p*
Fruits and vegetables	3.09	.92	3.07	.97	.57
Potato chips	1.97	.72	1.91	.69	**.03**
Burgers	1.92	.64	1.89	.67	.24
Candies	2.18	.89	1.92	.85	**<.001**

$t(1261) = 2.83$, $p = .05$, $d = .11$) and candies ($M = 2.09$, $SD = .81$, $t(1231) = 2.83$, $p < .001$, $d = .20$) in the second phase.

For students aged 12 and below, there was no significant differences in the consumption of both healthy and unhealthy foods between the two time periods. For the older students (aged 13 to 16), there were significant differences in the consumption of potato chips and candies between the two time periods. Students aged 13 to 16 report lower consumption of potato chips ($M = 1.92$, $SD = .66$, $t(1167) = 2.83$, $p = .005$, $d = .17$) and candies ($M = 2.04$, $SD = .81$, $t(1121) = 2.83$, $p < .001$, $d = .31$) in the second phase (Tables 7 and 8).

Discussion

This series of studies was conducted to examine the impact of a set of self-regulatory guidelines for food advertising on (a) the amount of unhealthy food advertisements shown on TV during children's peak viewing timings, (b) children's attitude toward unhealthy foods, (c) amount of unhealthy foods stocked in the household pantry, and (d) self-reported consumption of unhealthy foods among children. If one were to take a leap of faith and generalize from these findings, we could draw some conclusions on the impact of food advertising restrictions imposed through a self-regulatory approach.

First, Study One found that the proportion of overall unique ads marketing unhealthy food products fell (from 55.1% to 37.65%). Although 37.65% can still be

Table 7. Mean scores of health and unhealthy food consumption compared between age.

		12 and below			13 to 16		
		Mean	*SD*	*p*	Mean	*SD*	*p*
Fruits and vegetables	Phase 1	3.18	.92	.18	2.98	.90	.65
	Phase 2	3.16	.95		2.96	.98	
Potato chips	Phase 1	1.90	.69	.54	2.04	.75	**.005**
	Phase 2	1.89	.71		1.92	.66	
Burgers	Phase 1	1.86	.63	.32	1.98	.65	.42
	Phase 2	1.83	.66		1.96	.67	
Candies	Phase 1	2.08	.87	.36	2.30	.89	**<.001**
	Phase 2	2.03	.86		2.04	.84	

Table 8. Mean scores of health and unhealthy food consumption compared between gender.

		Male			Female		
		Mean	*SD*	*p*	Mean	*SD*	*p*
Fruits and Vegetables	Phase 1	3.03	.95	.14	3.16	.88	.94
	Phase 2	2.99	.99		3.15	.94	
Potato chips	Phase 1	1.98	.76	.25	1.95	.66	**.05**
	Phase 2	1.94	.70		1.88	.67	
Burgers	Phase 1	1.97	.68	.99	1.86	.59	.23
	Phase 2	1.95	.66		1.82	.67	
Candies	Phase 1	2.11	.89	.15	2.25	.87	**<.001**
	Phase 2	1.99	.88		2.09	.81	

considered a high number for unhealthy food ads, a significant decline of around one-fifth of all unique unhealthy food ads suggests that self-regulatory approaches can be useful in getting food companies to withdraw their advertising in those specified time-slots. A closer look at the data shows us that the decrease in fast food and unhealthy beverages advertising are the main contributors to the drop in total unique unhealthy food ads. This is unsurprising as the fast food and sugar-sweetened beverages industry consists of large multinational players that might be more inclined to adhere to self-regulatory guidelines. According to Ang (2013), successful self-regulation would require industries with (a) a competitive market, (b) small number of large players, (c) a motivated industry, and (d) statutory regulatory backstop. The food advertising restrictions imposed by the Advertising Standards Authority of Singapore has a statutory regulatory backstop in that civil action is possible under the Consumer Protection (Fair Trading) Act. In addition, the fast food and sugary drinks industry is highly competitive and consists mostly of large multinational players. As such, self-regulation has a higher chance of being effective in these industries. On the other hand, unhealthy convenience foods saw no decrease in the number of ads after the policy was implemented. It is possible that, due to the nature of the industry, consisting of both large players and small local and regional producers of convenience foods, self-regulation is potentially less effective.

Study Two found that attitude, in terms of positive affect towards consuming unhealthy foods, is significantly lower after policy implementation. This is unsurprising since food ads often use emotional appeals as a persuasive strategy in reaching out to children (Boyland and Halford 2013). It is possible that reduced exposure to these appeals decreased the availability and accessibility of positive affective associations

surrounding unhealthy foods (Ajzen 2001). Interestingly, cognitive attitude and negative affect towards unhealthy foods have not been significantly influenced. One likely explanation is that the reduction of unhealthy food advertising is a passive strategy in combating unhealthy food consumption and that cognitive attitudes and negative affect require more active strategies for change to occur. Advertising restrictions might be effective in reducing positive associations surrounding unhealthy foods, but not contribute to negative associations regarding unhealthy foods, which might require education and other communicative strategies to change.

Our study also found that households with children stocked significantly less unhealthy convenience foods such as chocolates, sweets, chicken nuggets, and hot dogs post-policy implementation. This finding corroborates with the results of study three, where self-reported consumption of candies also decreased post-policy implementation. As children wield significant influence with regard to family food purchases (Arnas 2006; Søndergaard and Edelenbos 2007), it is possible that children pester their parents less in purchasing the abovementioned food items, as a result of the lack of cues that prime children to pester purchase. Having said that, the results also show that some unhealthy food items did not see a decrease. There are a few potential reasons for that. First, items such as pizzas, corn chips, and burgers, are food items that are not commonly found among Singaporean households. The non-significant effects could be due to a statistical basement effect, where it is difficult to find a statistical difference due to it having low baseline amounts in the first place. Second, chocolates, sweets, nuggets, and hot dogs (those items that saw a decrease), might be considered "middle-range" snack items that are more likely bought when primed (such as through advertisements). On the other hand, items such as crackers might be common everyday snacks that are considered indispensable in the household and are bought out of habit by parents.

In Study Three, we found that the self-reported consumption of a number of unhealthy foods fell after the policy was implemented. The effect sizes were statistically small. This might be due to the fact that food consumption preferences and habits are formed over time and are highly resistant to change (Nicklaus et al. 2004). Nonetheless, the fact that there were small but significant reductions in the consumption of these energy-dense foods suggests that positive behavioral outcomes might be achieved from such food advertising regulations. One potential issue with such a conclusion was that the content analysis found no reduction in unhealthy convenience foods advertising, yet potato chips and candies (which are classified as unhealthy convenience foods) show a significant decrease in consumption among children. Some researchers have noted that advertising can often have spillover effects, where the impact of advertising exceeds the brand and sometimes even product category that is being advertised (Young 2003; Buijzen, Schuurman, and Bomhof 2008). From the perspective of social learning theory, these spill-over effects are a result of eating behaviors portrayed in ads, where similar behavior is learned and modeled by viewers (Bandura 1994). Based on social learning theory, modeled eating behavior can extend beyond the brand and to other types of food consumption, suggesting that unhealthy food advertising of any type can influence the intake of other energy-dense foods and even overall food consumption. The few studies that have examined these spill-over

effects seem to support this idea (Halford et al. 2007, 2004). Therefore, even though unhealthy convenience foods advertising might not have decreased significantly, it is possible that the reduction in spillover effects from other unhealthy foods advertising led to a decrease in the consumption of unhealthy convenience foods such as potato chips and candies. This begs the question: If the reduction of other types of unhealthy foods advertising can influence consumption across a variety of unhealthy food types, will restricting specific food advertising—such as unhealthy *convenience foods* advertising—lead to even greater effects?

Another interesting finding across the studies was the age and gender differences found in Study Two and Three. First, attitudinal and consumption changes appeared to apply to teenagers, rather than for those aged 12 and younger. This indicates an interesting spill-over effect of the food advertising restrictions since the targeted group for the policy was to protect children under the age of 12 (Advertising Standards Authority of Singapore 2016). Second, these pre-post policy differences seem to be stronger among girls than boys. A possible explanation could be that adolescents (aged 13 and above) are more impulsive and have greater brain plasticity, rendering them more vulnerable to advertising effects (Pechmann et al. 2005). The reduction in the number of food ads that they were exposed to during the study period could have reduced some of these more pronounced food advertising effects noted during pre-policy implementation. With regard to the differences being stronger among girls than boys, some scholars have suggested, based on a review of previous studies, that girls might be more vulnerable to health-related effects of food advertising on television (McGinnis, Gootman, and Kraak 2006). On a similar note, boys tend to be less concerned about healthful eating than girls, as girls might be more concerned about health and weight in general (Hobbs et al. 2006).

Our results suggest that the new policy introduced in Singapore had mixed outcomes, dependent on age and gender, in the short-term. The findings show that there are some, though not large, beneficial effects for children. Overall, the introduction of the regulations saw some beneficial effects across the entire advertising process, from a decrease in unhealthy food advertising input to some decrease in attitude towards consuming unhealthy foods, and modest reductions in the consumption of unhealthy foods among children and adolescents. Despite its minor protective effects, it was found that healthy food consumption behaviors such as fruit and vegetables intake remained constant after the introduction of the policy. As such, education efforts to improve healthy food consumption needs to complement food advertising restrictions in order to achieve better dietary outcomes among children, such as through parental education (Yee, Lwin, and Lau 2019). Age and gender differences found in our study also suggest some potential policy implications. First, the policy's muted effects on children 12 years old and younger suggests that more needs to be done to protect them. Specifically, the advertising restrictions might need to be tweaked in order to achieve greater protective effects on younger children. The existing policy in Singapore restricts food advertising to children in specific time belts (Advertising Standards Authority of Singapore 2016). However, it might be necessary to examine if restricting advertising during primetime—where children might be watching television with their families—is more effective than the current guidelines. It may also be

worthwhile for policymakers to consider the restriction of all advertising to children across media, as implemented in several other countries. Second, other types of nutrition education programs should be considered to target younger children and boys, who might not be beneficiaries of the policy. These can include education programs, interventions, or through the targeting of families in encouraging a healthier diet (Yee, Lwin, and Ho 2017).

Our study has several limitations that ought to be addressed. First, as the studies were conducted over a year between the two data collection phases, internal validity is lower than in controlled experiments. It is difficult to conclude with certainty that the differences between the two phases found in our study were indeed caused by the food advertising restrictions. For example, spurious relationships could have arisen due to other large-scale nutritional campaigns conducted during the period of our fieldwork. For example, during the period of our fieldwork, two national campaigns—the "life's sweeter with less sugar" and "national healthy lifestyle" campaign—were being launched (Health Promotion Board 2014a, 2014b). Although these campaigns were not targeted at children, they are potential confounds that ought to be noted. Future research should utilize experimental designs that include a control group in order to ascertain that these food advertising restriction effects exist within highly controlled experimental designs, as doing so would offer solid empirical evidence about the efficacy of such policies on health outcomes. Relatedly, Study Three was conducted with two different samples across two time points. There were minor differences in the demographic breakdown between the two time points (e.g. slightly more Malays and fewer Chinese in Phase Two), which could perhaps account for the observed differences. To account for this, we conducted a post hoc analysis and found that the difference between the two time points was significant only among Chinese participants, and not among the other races. This is likely due to the greater statistical power afforded from a larger sample of Chinese participants as there were decreases in the consumption of all three categories of unhealthy foods across racial groups, despite those differences being not statistically significant. In addition, the Malays, who saw an increase in the percentage of participants in Phase Two, reported higher consumption of unhealthy foods than the other racial groups. This means that the differences are unlikely due to the slight differences in the demographic makeup of the two samples. Second, as the study was conducted in the unique context of Singapore and its advertising landscape (self-regulatory approach with statutory backstop), the generalizability of our findings to other contexts is limited. As these regulatory policies are increasingly implemented in a growing number of countries, there is a need for future research to examine if differences in culture and regulatory landscapes, such as statutory vs. self-regulatory, can lead to different outcomes. Third, even though television remains a heavily used medium among children, an increasing amount of money is spent on online advertising. For example, a television food advertising restriction might probe companies to increase their advertising spending on online platforms instead, where it is harder to monitor and control, and where children and adolescents are increasingly spending their time on. With regard to this, a lesson can be drawn from the ban on tobacco advertising where—despite prohibitions of tobacco advertising in traditional media—big tobacco companies continue to use online platforms to

target young people (Kaplan 2018; Dunlop, Freeman, and Perez 2016). Future research ought to examine if regulation merely shifts food advertising expenditure to online platforms, where it could be easier to reach children in the long term. Finally, it is possible that such regulations might have garnered public interest, leading to social desirability bias in the self-reported measures of attitude and consumption in Studies Two and Three. This is mitigated by the fact that the Children's Code for Advertising Food and Beverage Products is a guideline that was ratified into the ASAS Code of Advertising Practice. Unlike an outright ban which would have garnered a high level of public attention, this is a self-regulatory code of practice and the discussions that took place around the development and inclusion of the Children's Code were only between the governmental agencies involved, ASAS themselves, and the F&B industry. It is very unlikely that the lay Singaporean public would be privy to the details of the guideline. Considering that our participants were children and adolescents, their awareness and interest in the code would have been low, given that media coverage of the Children's Code was relatively limited.

Numerous studies have highlighted the undesirable effects that food advertising have on children across the world. While efforts to examine its effects have been useful to justify policy action against food advertising, very few researchers have looked at the impact of food advertising restrictions on the targeted outcomes of these policies, especially across the entire process of advertising effects. Our study is one of the first few studies to assess the impact of such restrictions on a number of outcomes such as attitude towards, consumption of, and home inventory, of unhealthy foods. Taking the limitations of our study into account, our findings provide some empirical evidence to policymakers looking at implementing food advertising restrictions. Several important points were highlighted, namely that age and gender moderate some of these effects. These findings highlight the need for other educational efforts to complement such policies in encouraging a healthier diet among children. Most importantly, this study contributes to the growing field of research that highlights the harmful effects of advertising towards children, and how this might be addressed through a self-regulatory approach.

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