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Public Health/Obesity Prevention

The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review

S. Galbraith-Emami[1] and T. Lobstein[2]

[1]Public Health Policy Consultant, London, UK; [2]Policy and Programmes, IASO, London, UK

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Address for correspondence: Dr Tim Lobstein, Policy and Programmes, IASO, Charles Darwin House, 12 Roger St, London WC1N 2JU, UK.
E-mail: tlobstein@iaso.org

Summary

In response to increasing evidence that advertising of foods and beverages affects children's food choices and food intake, several national governments and many of the world's larger food and beverage manufacturers have acted to restrict the marketing of their products to children or to advertise only 'better for you' products or 'healthier dietary choices' to children. Independent assessment of the impact of these pledges has been difficult due to the different criteria being used in regulatory and self-regulatory regimes. In this paper, we undertook a systematic review to examine the data available on levels of exposure of children to the advertising of less healthy foods since the introduction of the statutory and voluntary codes. The results indicate a sharp division in the evidence, with scientific, peer-reviewed papers showing that high levels of such advertising of less healthy foods continue to be found in several different countries worldwide. In contrast, the evidence provided in industry-sponsored reports indicates a remarkably high adherence to voluntary codes. We conclude that adherence to voluntary codes may not sufficiently reduce the advertising of foods which undermine healthy diets, or reduce children's exposure to this advertising.

Keywords: Advertising, children, food industry, regulation.

obesity reviews (2013)

Introduction

The promotion of potentially unhealthy food and beverage products is now widely recognized as a significant risk factor for child obesity and for the development of chronic disease. Reviews conducted for the World Health Organization (WHO) (1,2), for European parliamentarians (3,4) and for national agencies in the UK (5) and the United States (6) have concluded that, despite substantial gaps in the evidence, advertising and promotional marketing of foods and beverages have a sufficient negative effect on children's diets to merit action. There is general agreement that messages about food and diet should support national dietary guidelines and in 2004 the World Health Assembly adopted a global strategy on diet, physical activity and health which explicitly called on the private sector to promote healthy diets in accordance with national guidelines and international standards, and to practise responsible marketing to support the strategy (7).

During the last decade, consumer groups, parents, teachers' professional associations and public health advocacy organizations have called for greater control on the marketing of foods and beverages to children. In 2007, the World Health Assembly called for a set of recommendations for member states on marketing of foods and beverages to children (8), and by 2010 at least 22 countries around the world had published policies on marketing to children which included statutory controls, industry-led

self-regulation and co-regulatory arrangements (industry led with government oversight) (9).

Countries including Norway, Sweden and the province of Quebec, Canada, have statutory regulation restricting the advertising of any product, not only food and beverage products, which have been in place for decades. The UK introduced regulation to restrict advertising of specified foods and beverages, which applied to programming of appeal to children on terrestrial television from January 2008, and cable and satellite channels from January 2009. South Korea introduced regulation to restrict the advertising of energy-dense, nutrient-poor foods to children in January 2010 (9).

Leading food and beverage companies have responded directly to this issue by proposing a series of company-led pledges to change their marketing activities directed at children, so that the mix of foods advertised to children would encourage healthier dietary choices and healthy lifestyles. The first initiatives were undertaken in 2006 by 10 food and beverage companies in the United States and coordinated by the Children's Food and Beverage Advertising Initiative (CFBAI, sponsored by the Better Business Bureau) (10), whereby the companies defined the programs in which they would restrict their marketing (e.g. TV programs in which 50% of the audience is aged under 12 years) and the products that they would or would not promote (each company proposed its own categorization of its products for this purpose). The numbers of companies signing to the CFBAI increased over subsequent years to 16 by 2012 (11).

In December 2007, 11 major food and beverage companies operating in Europe announced a common commitment to change the way they advertise to children under the age of 12 in the European Union (EU), in support of the European Union's Platform for Action on Diet, Physical Activity and Health, with individual company pledges to be introduced by the end of 2008, under an overarching pledge not to advertise to children under age 12 except for products that fulfilled company-specified nutrition criteria (12). The number of EU Pledge signatories rose to 19 by late 2012, and the companies state that their advertising represents 80% of food and beverage advertising expenditure in the EU (13).

In 2008, ten globally active companies launched the International Food and Beverage Association (IFBA), which presented a series of commitments including one in which the signatory companies agreed to voluntarily introduce restrictions on advertising to children worldwide (14). In December 2008, IFBA sent a letter to the Director-General of the WHO announcing that individual pledges had been extended globally, committing the signatory companies 'to only advertise products to children under 12 years of age that meet specific nutrition criteria, which are based on accepted scientific evidence and/or national and international dietary guidelines; or to not advertise products at all to children under 12' (15).

In January 2009, the Australia Food and Grocery Council introduced the Responsible Children's Marketing Initiative, with immediate effect, which restricted advertising to children aged 12 and younger, unless the products being advertised furthered the goal of promoting healthy dietary choices and healthy lifestyles (16). Australian fast food companies made a similar commitment to promote only food and beverages that represent healthier choices to children under age 14 years (the Quick Service Restaurant Industry initiative) (17).

These pledges specifically address controls on marketing food and beverages to children and are in addition to the long-standing industry-wide codes of conduct and national regulations on advertising and product promotion. By 2012, some 22 national and regional pledges involving over 90 companies (ranging from 6 to 26 companies in any given national or regional pledge) had been documented (18), with some companies making different pledges with different criteria, in different regions of the world. Comparison of different company pledges and statements shows inconsistency in terms of the media formats included, the age of children, the proportion of children in the audience, and especially the types of foods which would and would not be restricted which makes evaluation of the real impact of the pledges hard to assess. The coordinating bodies for the pledge-making companies have published annual reports (19) showing levels of compliance above 96%, indicating a remarkable level of restriction of children's exposure to the marketing of unhealthy foods or, possibly, that the criteria being used are not appropriate for measuring exposure and impact.

The WHO's set of recommendations on the marketing of foods and non-alcoholic beverages to children published in 2010 urges Member States to commit to 'designing new and/or strengthening existing policies on food marketing communications to children in order to reduce the impact on children of marketing of foods high in saturated fats, trans-fatty acids, free sugars, or salt' and notes that a variety of mechanisms may be considered, including industry self-regulation and voluntary initiatives. Many WHO Member States have relied on self-regulatory pledges as their principle strategy for reducing marketing pressure on children (9). In the United States, the report of the White House Task Force on Childhood Obesity gave support for self-regulation, with the further recommendation: 'if voluntary efforts to limit the marketing of less healthy foods and beverages to children do not yield substantial results, the Federal Communications Commission could consider revisiting and modernizing rules on commercial time during children's programming' (para. 2.9) (20). Similar support for self-regulation was given by the European Commission in their 2007 White Paper Strategy for Europe

on nutrition, overweight and obesity health-related issues, which noted that this policy would be reviewed subsequently in order to 'determine whether other approaches are also required' (21).

In the present paper, we seek to summarize evidence on the impact of regulation and industry self-regulation on curbing children's exposure to the advertising and commercial promotion of less healthy foods and beverages. By 'exposure' we include indicators for the numbers, proportions or frequency of promotional marketing messages to which children are likely to be exposed, or direct measures of exposure such as number of spots multiplied by child audience ratings, or numbers of child advertising impacts.

Two approaches are taken: the first examines evidence for changes in children's exposure before and after the introduction of government regulation or self-regulatory pledges. The second approach considers the absolute levels of exposure in the period after the introduction of the self-regulatory pledges in countries or regions where no earlier data are available for comparison.

Methodology

A systematic review of the peer-reviewed literature was undertaken. This literature review was designed to capture reports of data on the levels of exposure of children to various marketing practices for foods and beverages in recent years. The search was conducted using the Web of Science, PubMed, Science Citation Index, JSTOR and Business Source Direct databases. The terms [food OR diet OR beverage] AND [market* OR advert*] AND [regulat*] AND [child*] were used. The search was limited to papers published after 1 January 2008 since earlier studies would not show levels of exposure around the time of the introduction of recent regulation or voluntary self-regulation and in the years following. The search was undertaken in three databases in October 2012 and repeated for all five databases in April 2013. Each paper was examined by both authors for relevance and suitability. Papers were included if they contained original research data not duplicated elsewhere. The references cited in these papers were also examined for potential inclusion. Data were extracted from each study using the headings shown in Tables 1 and 2.

A second search was made for reports published by government departments and government-sponsored agencies, market-monitoring agencies or research institutes. This was limited to English-language-speaking countries or regions, and consisted of searches for reports cited on websites of organizations which themselves were mentioned in any of the first 100 'hits' listed by Google in response to the search term 'children advertising food' in each of the six domains: google.com (United States), google.co.uk (UK), google.com.au (Australia), google.co.nz (New Zealand), google.ca (Canada) and google.ie (Republic of Ireland). The search was undertaken in January 2013. Reports obtained through these links were also subjected to data extraction under the headings shown in Tables 1 and 2.

Data were extracted by one reviewer and checked by the other reviewer. Where necessary, authors were contacted to clarify published data and provide supplementary information. During the review process, the authors agreed that a meta-analysis was inappropriate because of the substantial heterogeneity in the survey methodologies and in the exposure outcome metrics reported across studies.

Results

The search of the journal databases produced a list of 614 potentially eligible papers. Of these, 502 were eliminated as not likely to contain original survey data on the basis of their titles. Abstracts of the 112 remaining papers were examined and 80 were eliminated due to duplication or lack of relevant data for recent years. Full papers of the 32 remaining abstracts were obtained and a further 11 were excluded as not having relevant information on the levels of advertising or of children's exposure to promotional marketing practices for foods or beverages. The remaining 21 papers are shown in Table 1.

The analysis of the first 100 Google 'hits' in each of the six countries returned 600 links to websites. After elimination of duplicates, 230 websites were inspected, and these cited a total of 71 organizations making statements about children's exposure to food and beverage marketing. The websites of these organizations were inspected and 28 reports with data on children's exposure downloaded for examination. Inclusion criteria were (i) data were original and sufficiently detailed to be analysed and (ii) data had been collected by a reputable research agency, university department, professional or commercial organization or government department or authority. When data were reported as a sequential series, e.g. annual reports, the most recent report was accepted. After exclusions and the elimination of duplicate data sources, a total of four non-industry-sponsored and seven industry-sponsored reports were included.

Table 1 shows the extracted information from each of the papers and reports analysed for this study. For the first objective, which is to compare survey data obtained shortly before the introduction of the self-regulatory pledges with survey data obtained after their introduction, we found a total of eight papers in peer-reviewed journals and six reports from other sources (of which two were industry sponsored), with information available for a total of 10 countries or regions. For the second objective, which is to assess the levels of exposure in countries in recent years, a total of 12 peer-reviewed papers and five reports were found, covering 21 countries or regions.

Table 2 provides the summary results and conclusions extracted from each of the papers and reports, focusing on

Table 1 Description of the papers and reports included for analysis

Author (year)	Details of advertising data				Definition of media and children	Coding schemes	Outcome measures
	Country/region	Regulation start date(s)*	Source of data and survey date(s)	Media sample period/extent			
Peer-reviewed papers comparing data before and following statutory regulation or self-regulation							
Adams *et al.* (2012) (22)	UK (regional)	Statutory agency regulation January 2008.	Commercial monitoring data 2006 and 2009	TV: 1 week, repeated	All channels available in the Tyne Tees region; PMVs for children aged 4–15 years.	Nutrition: HFSS profiling scheme (FSA, 2009) (23)	Exposure: person-minute-views for HFSS and non-HFSS food advertisements
Effertz & Wilcke (2012) (24)	Germany	EU Pledge self-regulation January 2009.	Authors' surveys 2007–2008, 2010	TV: 4 d at 16 h d^{-1} (2007–2008); 2 d at 16 h d^{-1} (2010)	Children's popular German TV channels 6 a.m.–10 p.m.; children aged 3–13 years and 14–19 years	Food: core vs. non-core (see Kelly *et al.* 2010) (25)	Proportion of advertising for core and non-core products
Han *et al.* (2012) (26)	South Korea, 13 regions	IFBA self-regulation*	Commercial monitoring data 2004–2009	TV: annual ratings (viewing audience size)	Ads per day across all channels; children in rating categories 4–12 years and 13–19 years	Four product categories (fast food, sweets and snacks, beverages, instant noodles) plus subcategories	Exposure: average number of advertisements seen daily using ratings data
Harris *et al.* (2010) (27)	United States (North East)	CFBAI self-regulation 2007	Authors' surveys 2006, 2007, 2008	Food packaging: all supermarket products with cross-promotions for third-party products	Products with cross-promotions appealing to children <6 years, children <12 years and other	Food categories; nutrition according to IOM school food guidelines (Tier 2 foods) (IOM 2007) (28)	Number of promoted products and cross-promotions
Hebden *et al.* (2011) (29)	Australia (regional)	QSRI (fast food) self-regulation August 2009	Authors' surveys 2009, 2010	TV: 4 d at 16 h d^{-1}, repeated	Three main Sydney free-to-air channels; hours when child audience >25% of maximum child audience for the day; children 5–12 years	Food: core vs. non-core, extended for fast foods (25)	Number and frequency of advertisements for core and non-core products
Kim *et al.* (2013) (30)	South Korea	IFBA self-regulation*; statutory regulation January 2010	Authors' surveys 2009, 2010	TV: 4 months at 24 h d^{-1}, repeated	Four commercial terrestrial channels and Tooniverse cable. 5 p.m.–7 p.m. vs. all hours	Nutrition: EDNP (energy-dense and nutrient-poor) vs. non-EDNP foods (Korean national guidelines)	Exposure: gross rating points (number of spots × audience reach); also advertising budget and number of advertisements
King *et al.* (2012) (31)	Australia (regional)	AFGC (food grocers) self-regulation January 2009, QSRI (fast food) August 2009	Authors' surveys 2006, 2007, 2009–2011	TV: 7 d at 15 h d^{-1} (2006 and 2007), 4 d at 15 h d^{-1} 2009–2011, repeated	Three main Sydney free-to-air channels; child exposure assumed in 'peak hours': 6:00 a.m.–9:00 a.m. weekday, 6:00 a.m.–12:00 noon weekend, 4:00 p.m.–9:00 p.m. every day	Food: core vs. non-core, extended for fast foods (25)	Number and frequency of advertisements for core and non-core products
Powell *et al.* (2012) (32)	United States	CFBAI self-regulation 2007	Commercial monitoring data 2003, 2005, 2007, 2009	TV: annual ratings (viewing audience size)	Ads per day across all channels; children in rating categories 2–5 years and 6–11 years	Product categories classified as high in saturated fat, sugar or sodium (fast food, cereal, sweets, beverages, snacks)	Exposure: audience ratings for age groups and food categories
Peer-reviewed papers with data following regulation/self-regulation							
Boyland *et al.* (2011) (33)	UK	Statutory agency regulation January 2008.	Authors' survey 2008	TV: one weekday and one weekend day per month for 12 months at 16 h d^{-1} (6: 00 a.m.–10:00 p.m.)	Fourteen commercial stations with high-viewing shares for children 4–15 years, or 'recently viewed' in a survey of children 5–16 years. 'Peak' times (with >25% potential child audience) 5:30–10:00 p.m. weekdays and 7:00–9:00 p.m. weekends.	Food: core vs. non-core (25)	Number of advertisements for core and non-core products
Brady *et al.* (2010) (34)	Canada	Statutory regulation in Quebec 1978, self-regulation CAI January 2008	Authors' survey 2009–2010	Website content of food manufacturers	Twenty-four websites owned by 10 CAI signatories; rated for features likely to appeal to children <12 years	Food: categories assessed against Eating Well with Canada's Food Guide (35)	Techniques used on websites targeting children

Table 1 *Continued*

Author (year)	Details of advertising data				Definition of media and children	Coding schemes	Outcome measures
	Country/region	Regulation start date(s)*	Source of data and survey date(s)	Media sample period/extent			
Castillo-Lancellotti *et al.* (2010) (36)	Chile	IFBA self-regulation*	Authors' survey 2009	TV: 350 h over 3 weeks, 9:00 a.m.–10:00 p.m.	Frequency of ads on all five Chilean television channels: ads categorized as child or family targeted vs. other targeted	Nutrients: fat, sugar, salt classified according to UK 'traffic light' coding (37)	Number of advertisements for different product categories
Jones *et al.* (2012) (38)	Australia	AFGC (food grocers) self-regulation January 2009, QSRI (fast food) August 2009	Authors' survey 2009	Print: 1 year	All issues of Australian children's magazines published in the calendar year 2009	Food: core vs. non-core (25)	Numbers and types of print advertisements and brand-checked advertorials
Potvin Kent *et al.* (2011) (39)	Canada (regional)	Statutory regulation in Quebec 1978, self-regulation CAI January 2008	Authors' survey 2009	TV: 7 d at 18 h d^{-1}, filtered for English- and French-speaking children's preferred viewing times (by survey)	32 television stations in two provinces (Ontario and Quebec); children aged 10–12 years	Categories: candy and snacks, beverages, restaurants, grain products, fruits and vegetables, dairy products, meat, poultry, fish and alternative, prepared foods, others	Numbers of advertisements, contests and sponsorships, by product categories
Potvin Kent *et al.* (2011) (40)	Canada (regional)	Statutory regulation in Quebec 1978, self-regulation CAI January 2008	Authors' survey 2009	TV: 7 d at 18 h d^{-1}, filtered for English- and French-speaking children's preferred viewing times (by survey)	32 television stations in two provinces (Ontario and Quebec); children aged 10–12 years	Nutrition: content and HFSS profiling scheme (23)	Number and type of advertisements
Potvin Kent *et al.* (2012) (41)	Canada (regional)	Statutory regulation in Quebec 1978, self-regulation CAI January 2008	Authors' survey 2009	TV: 7 d at 18 h d^{-1}, filtered for English- and French-speaking children's preferred viewing times (by survey)	32 television stations in two provinces (Ontario and Quebec); children aged 10–12 years	Food categories (see Potvin Kent 2011 (39)) and HFSS nutrient profiling scheme (23)	Number and type of advertisements
Quilliam *et al.* (2011) (42)	United States	CFBAI self-regulation 2007	Authors' survey 2009	Websites owned by food marketers which offered interactive games	146 interactive games with no age restrictions or with appeal to younger children	Nutrition: IOM school food guidelines (Tier 2 foods) (28)	Prevalence and nature of adver-games on food company websites
Roberts *et al.* (2012) (43)	Australia (five largest cities)	AFGC (food grocers) self-regulation Jan 2009, QSRI (fast food) August 2009	Commercial monitoring data 2010;	TV: Two months at 24 h/d	Four main free to air channels in Sydney, Melbourne, Brisbane, Perth, and Adelaide; children's programming defined by each broadcaster ('C' schedules)	Foods: Core vs non-core (25)	Number and type of advertisements
Romero-Fernández *et al.* (2010, 2013) (44,45)	Spain	PAOS self-regulation September 2005	Authors' survey 2008	TV: 8 d at 10 h d^{-1} (8:00–11:00 a.m., 1:00–3:00 p.m., 5:00–10:00 p.m.)	Two days per channel for each of four of the 10 Spanish free-to-air channels, ads targeted at children <12 years	PAOS Code signatories and non-signatories; HFSS nutrient profiling scheme (23).	Number and type of advertisements
Sixsmith & Furnham (2009) (46)	UK	Statutory agency regulation January 2008	Authors' survey 2008	TV: 5 d at 9 h d^{-1} (9:30 a.m.–6:30 p.m.)	Leading commercial channel (ITV1) 'day-time TV' adverts aimed at adults and at children (age not specified)	Content analysis of methods used to promote food products; foods categorized by type and by 'healthy' and 'unhealthy' (fat, sugar and salt levels)	Number and type of advertisements

Table 1 *Continued*

Author (year)	Details of advertising data				Definition of media and children	Coding schemes	Outcome measures
	Country/region	Regulation start date(s)*	Source of data and survey date(s)	Media sample period/extent			
Speers *et al.* (2011) (47)	United States	CFBAI self-regulation 2007	Commercial monitoring data 2008	TV: 1 year's food, beverage and restaurant brand appearances in programs (paid or unpaid) and TV ads, with Nielsen ratings	Programs viewed by the average child (2–11 years), adolescent (2–17 years) and adult	Food products, beverage products, restaurants, other (subcategories)	Exposure: number and audience viewings of advertisements
Tarcza & Olar (2011) (48)	Romania	EU Pledge self-regulation January 2009	Authors' survey 2010	TV: 2 d, 7:00 a.m.–10:00 p.m.	Channels not stated. Hours defined as 'prime time' for children: ages 8–12 years.	Content analysis of methods used to promote food products; foods categorized as high in fat or sugar, and others	Number and frequency of advertisements by type
Government agency and academic reports comparing data before and following statutory regulation or self-regulation							
Brindal *et al.* (2012) (49)	South Australia	AFGC (food grocers) self-regulation January 2009, QSRI (fast food) August 2009	Commercial monitoring data 2008, 2010	TV: repeated 4-d periods on free-to-air and Pay TV channels	Audience percentage for age groups 0–12, 5–12 and 0–14 years; impacts (no. of ad spots × no children viewing)	Foods: core and non-core (25)	Exposure: impacts in age groups; also audience percentages
Kunkel *et al.* (2009) (50)	United States	CFBAI self-regulation 2007	Authors' surveys 2005, 2009	TV: 2 composite days (one episode of all children's shows aired regularly 7:00 a.m.–10:00 p.m.)	Five national channels and two children's cable channels: all shows with V-chip or E/I rated for >12 years	(a) 'Go, Slow, Whoa' categories (51) (b) Pledge company definitions	Number and type of advertisements
Ofcom (2010) (52)	UK	Statutory agency regulation January 2008.	Commercial monitoring data 2005, 2009	TV: 3-month (first quarter) spots and impacts	All dedicated children's channels and programmes aimed at children, and programmes with an audience in which children under 16 are over-represented (120% of their proportion in the national population)	Nutrition: HFSS nutrient profiling scheme (23)	Exposure: impacts in age groups
Rudd Center (2012) (53)	United States	CFBAI self-regulation 2007	Commercial monitoring data 2004, 2007, 2011	TV: all national, cable and local channels	Annual gross rating points (number of spots × audience reach) children aged 2–11 and 12–17 years	Food and beverage categories defined by commercial data supplier	Exposure: audience ratings by age groups for advertisements by type
Industry-sponsored reports comparing data before and following self-regulation							
Accenture (2012) for IFBA (54)	Australia, Brazil, China, India, Mexico, New Zealand, Russia, South Africa, Thailand, Ukraine	IFBA Pledge January 2009	Commercial monitoring data 2011	TV: 3-month spots, all countries; print: 40 publications in 7 countries (not Mexico, Thailand, Ukraine); Internet: 100 websites targeted at children in 7 countries (see print)	TV with >50% viewers <12 years; print 'children's titles' based on national media industry; websites selected as 'child-oriented' (excluding food company-owned websites)	Nutrition: Pledge company definitions	TV: number and type of advertisements when children are majority of viewers. Print and websites: number and type of advertisements.
Advertising Standards Council Canada (2012) (55) for The Canadian CFBAI (CAI)	Canada	Statutory regulation in Quebec 1978, self-regulation CAI Jan 2008	Source not stated 2011	TV: 10-d monitoring. Print: 16 issues of four publications. Adver-games: three participants' websites and other sites.	TV: four channels 'specifically directed to the under-12 audience'. (Pledge company criteria vary between >25 and >35% audience <12 years). Print: 'child-directed' publications.	Nutrition: Pledge company definitions, and CAI analysis of products for nutrient content	Proportion of compliant TV ads, print ads and products featured in adver-games

Table 1 *Continued*

Author (year)	Details of advertising data				Definition of media and children	Coding schemes	Outcome measures
	Country/region	Regulation start date(s)*	Source of data and survey date(s)	Media sample period/extent			
Australian Food and Grocery Council (2012) (56)	Australia	AFGC self-regulation January 2009	Commercial monitoring data 2010, 2011	TV: two weeks (free-to-air channels, in five major cities)	All programmes classified as pre-school and children, plus programmes appearing to target children or with >50% audience children <12 years	Foods: core and non-core (25)	Proportion of compliant advertisements
Kolish & Hernandez (2012) (57)	United States	CFBAI self-regulation 2007	Children's Advertising Research Unit monitoring 2009, 2010, 2012	TV: 31 h from 'different day parts on weekdays and the weekend from one week'; print: 'a variety of titles'; websites: third-party sites. Schools.	TV: programming with >35% child audience <12 years. Print: 'titles popular with children under 12'. Internet: third-party websites 'primarily directed to children under 12'. Schools: elementary schools.	(a) Pledge company nutrition definitions (b) CFBAI analysis of products for 'food groups to encourage' or a 'good source' of an important nutrient	Numbers and proportion of compliant advertisements
EU Pledge (2012) (58)	Germany, Hungary, Italy, Poland, Portugal	EU Pledge January 2009	Commercial monitoring data 2005, 2012	TV: first quarter total spots in five sample countries. Websites: 'marketing messages' on 210 Pledge company-owned websites. Schools: 100 in each of three countries.	TV with >35% audience <12 years, and all TV; Websites: messages designed to target children under 12. Schools: primary schools.	Nutrition: pledge-company-defined products, and all Pledge companies' products	Exposure: TV impacts on children for compliant advertisements and for all Pledge members' advertisements. Websites: number compliant. Schools: number with reported presence of advertising in sample schools.
Forum for Fødevarereklamer (Denmark) (2010) (59)	Denmark	Danish Food Forum self-regulation 2007	Commercial monitoring data 2004–2010	TV: Channel TV2, (5:30–11:00 every day)	Annual targeted rating points (number of spots × audience reach × proportion of audience in target market) children age 3–11 years	Nutrition: forum nutrient profiling scheme applied to all products	Exposure: TRPs by product type
UNESDA (2011) (60)	Belgium, France, Germany, Italy, Poland, Spain, UK	UNESDA Pledge January 2007, EU Pledge Jan 2009	Commercial monitoring data 2010	TV and print: 2 weeks sampled in 7 countries. Websites: advertising on third-party sites in seven countries and child-focused sites in five countries and company sites. Schools sampled in three countries.	TV with 50%+ viewers <12 years. Print: >50% audience <12 years. Websites with material 'likely to attract and audience >50% children >12 years. Schools: primary schools.	Any soft drink products	Proportion of advertisements, sites and locations compliant

*The IFBA self-regulation pledges applied globally from January 2009 (15).
PMV, person-minute-view; TRP, targeted rating point.

Table 2 Summary findings from the papers and reports

Author (year)	Summary of findings	Authors' conclusion
Peer-reviewed papers comparing data before and following statutory regulation or self-regulation		
Adams *et al.* (2012) (22)	25% increase in child exposure (PMVs) to HFSS ads across all TV programming, 2009 over 2006. 119% increase in all population (age >4 years) exposure (PMVs) to HFSS ads across all TV programming, 2009 over 2006.	'Despite evidence of good adherence to the new scheduling restrictions on television food advertising to children, exposure of children to advertisements for "less healthy" foods was unchanged following their introduction. Exposure of all viewers to advertisements for "less healthy" foods increased following introduction of the restrictions. The restrictions did not achieve their aim and this is likely to be because they only applied to a very small proportion of all television broadcast. In fact, the scheduling restrictions appear to have had a perverse effect of increasing exposure of all viewers to HFSS food advertising.' (p. 5)
Effertz & Wilcke (2012) (24)	Comparing the same three channels from 2007–8 to 2010, the absolute number of ads fell from 4,924 to 2,657. The proportion of ads for non-core foods rose from 12.8 to 18.2% while the proportion of ads for core foods fell from 1.7 to 0.3%. In both periods, the use of persuasive marketing techniques was greater for non-core foods than for other foods or for toys.	'The exposure to commercials for non-core foods and the use of techniques attractive to children are widespread and appear to have remained unaffected by the announcement of the EU Pledge in December 2007 . . . the industry's voluntary agreement has failed to fulfil its declared purpose.' (p. 1466)
Han *et al.* (2012) (26)	Number of food ads seen per day fell 19% for all viewers, 33% for children and 35% for adolescents, for 2009 compared with 2004. For children, beverage ads seen fell 22%, sweets and snacks 73%, fast food 30% and instant noodles 25%. For adolescents the equivalent figures were falls of 31, 71, 21 and 28%.	'Differential trends found in exposure across and within food product categories and differences by age groups highlight the need for continued monitoring to help inform the regulatory policy debate.' (p. 1)
Harris *et al.* (2010) (27)	The number of cross-promotional products increased from 96 to 171 over the years 2006–2008. In 2006, 60 targeted children <12 years and 11 children <6 years; in 2008 the figures were 52 and 23. Over the period, mean fat and sodium levels increased, and sugar levels remained high. Sugar levels and sodium levels tended to be highest in products targeted at children <12 years. In 2008, over two-thirds of products did not meet the IOM healthy eating criteria, and there was no nutritional improvement in products from CFBAI signatory companies.	'. . . self-regulation by the food industry may not produce any meaningful improvement in the food environment that surrounds young people. . . . A continued absence of real progress in the marketing environment is likely to reinforce support for more direct interventions, including government regulations to enforce reductions in unhealthy food marketing to youth.' (p. 416)
Hebden *et al.* (2011) (29)	Increase in number of fast food ads for all viewers from 1.1 to 1.5 h^{-1}, 2010 over 2009. No change in the number of non-core fast-food ads for all viewers (1.0 h^{-1}) and for children (1.3 h^{-1}) 2010 over 2009. Non-core fast food ads as a proportion of all fast food ads decreased for non-Pledge companies more than for Pledge companies.	'The frequent advertising for non-core fast foods found in this study continues to promote excessive energy intake and increased risk of weight gain. . . . The limitations of current industry-based self-regulatory initiatives that are illustrated in our study reinforce the recommendations of the World Health Organization on the need for government leadership to set the policy framework and key definitions for restrictions on food marketing to children.' (p. 23)
Kim *et al.* (2013) (30)	After implementation of a South Korean regulation on advertising to children in January 2010, all indicators (the total adverting budget and number of ad placements and GRPs) decreased for EDNP food products during all hours and during regulated hours (5:00 p.m.–7:00 p.m.). GRPs for EDNP foods fell 57% across all hours and 82% in restricted hours.	'These results suggest positive changes in TV advertising practices of food companies because of the regulation, thereby lowering children's exposure to TV advertising of EDNP foods.' (p. 1)
King *et al.* (2012) (31)	Comparing 2011 with 2006, for children's peak hours, total food ads per hour declined 21%, ads for non-core foods declined 23%, ads for non-core foods excluding fast foods declined 44%, ads for fast foods increased 34%.	'Findings from the study indicate the current industry self-regulation has had minimal impact in reducing children's exposure to unhealthy food advertising . . . [the study] supports the need for stronger regulatory systems, including a formal, independent monitoring system, in order to achieve meaningful reductions in children's exposure to unhealthy food marketing.' (p. 6)
Powell *et al.* (2011) (32)	The number of food ads seen by children aged 2–5 years fell 33%, and for children 6–11 years 22%, comparing 2009 with 2003. For children 2–5 years, beverage ads fell 43%, cereals 30%, snacks 44% and sweets 55%. Fast food ads increased 21% and full-service restaurant ads increased 49%. For children 6–11 years, equivalent figures were falls of 41, 12, 32 and 44%. Ads for fast food increased 31% and for full-service restaurants 50%. The percentage of food ads with high levels of saturated fat, sugar or sodium fell from 94 to 86% for children 2–5 years, and from 94 to 87% for children 6–11 years.	'By 2009, there was not a substantial improvement in the nutritional content of food and beverage advertisements that continued to be advertised and viewed on television by US children.' (p. 1078)
Peer-reviewed papers with data following regulation/self-regulation		
Boyland *et al.* (2011) (33)	Of 18,888 food and beverage ads, 56% were non-core foods and 18% core foods. Top 8 non-core food ads were for fast food, non-core breakfast cereals, confectionery, spreads, alcohol, snack foods, full-fat dairy products, soft drinks. The proportions of core and non-core food ads did not differ significantly between children's peak viewing times and non-peak viewing times. Fewest food ads were aired around child-specific programs, and most around soap opera programs followed by general entertainment: the proportion of non-core foods did not differ across program types.	'Legislation of HFSS food advertising to children is a positive step to achieve reductions in children's exposure to such advertising, particularly during dedicated children's programming. There is still scope for strengthening the current regulatory arrangement, to reduce children's exposure to HFSS food advertising broadcast not specifically aimed at a young audience but watched by children in significant numbers.' (p. 461)

Table 2 *Continued*

Author (year)	Summary of findings	Authors' conclusion
Brady *et al.* (2010) (34)	23 of the 24 sites showed product logos and/or packs. 18 sites promoted confectionery, 8 sites sweetened breakfast cereals, 8 sites milk and alternatives, 5 sites potato chips, 4 sites meat and alternatives, 3 sites crackers, 2 sites soft drinks, 2 sites vegetables and fruits, and 1 site each for sports drinks, fast foods and cookies. The large majority of sites promoted products that did not feature in the Canadian guidance for healthy eating.	'Our findings show that exceedingly sophisticated and highly engaging marketing techniques promoting nutritionally poor branded food and beverage products pervade children's online environment.' (p. 170) 'These techniques may contradict the spirit of the CFBAI. Innovative regulatory guidelines are needed to address modern marketing media.' (p. 166)
Castillo-Lancellotti *et al.* (2010) (36)	The majority of food ads (56.6%) were targeted at children or families. Of these, 13% were for healthy foods, 8% moderately health foods and 79% for unhealthy foods (at least one 'red' traffic light).	'There is a predominance of advertising aimed at children associated with unhealthy foods, suggesting the need to regulate and to encourage food companies to develop food products with enhanced nutritional quality.' (p. 91)
Jones *et al.* (2012) (38)	Of the 269 branded food references identified in 139 magazines, 86% were for non-core products. Of the branded food references, 31% were in ads, 39% in editorial product placements, and 25% in competitions and puzzles.	'. . . industry initiatives to reduce the targeting of children have not carried through to magazine advertising. This study adds to the evidence base that the marketing of unhealthy food to children is widespread and often covert, and supports public health calls for the strengthening of advertising regulation.' (p. 220)
Potvin Kent *et al.* (2011) (39)	Comparing ads viewed by Ontario English-speaking, Quebec English-speaking and Quebec French-speaking children, a significantly smaller number of food ads were targeted at pre-school, children and teens on TV watched by French-speaking Quebec children. Candy and snack, restaurant, and grain product ads were less frequently viewed but beverage ads more frequently viewed by French-speaking Quebec children. The viewing of 'fun' themes and media celebrities in food ads was significantly lower among French-speaking Quebec children.	'The Quebec advertising ban does not appear to be limiting the amount of food/beverage advertising seen by children aged 10–12. However, food categories and marketing techniques used differ in the preferred viewing of French Quebec children.' (p. 433)
Potvin Kent *et al.* (2011) (40)	Comparing ads from signatories to the self-regulation with ads from non-signatories: signatories were responsible for significantly more food/beverage promotions, and used media characters and repetition more frequently in their food/beverage promotions than the non-signatories. Nutritionally, signatories' food/beverage ads were for products higher in fats, sugar, sodium and energy per 100 g. A significantly greater proportion of signatories' ads were for HFSS products compared with non-signatories' ads.	'With the exception of the four corporations that did not market to children at all, the commitments that have been made in the CAI are not having a significant impact on the food and beverage marketing environment on television which is viewed by 10–12-year-olds.' (p. 401)
Potvin Kent *et al.* (2012) (41)	This analysis found that the average nutrition content of food ads viewed by the Quebec French sample showed higher levels of fat, saturated fat, sugar and salt than those viewed by English-speaking children in Quebec or Ontario. However, the distribution of products was such that a smaller percentage of the ads viewed by Quebec French-speaking children was classified as 'high fat, sugar or sodium', and a smaller percentage of total food ads was classified as 'less healthy' compared with ads viewed by Ontario and Quebec English samples.	'These results suggest that the Quebec advertising ban is influencing the macronutrient profile of advertised foods viewed by French Quebec children during their preferred viewing and that their promotions are marginally healthier than that viewed by the English samples.' (p. 1829)
Quilliam *et al.* (2011) (42)	Of 70 adver-games for children on sites owned by CFBAI-signatory companies, 55 promoted only unhealthy foods, 9 healthy foods, and 6 both healthy and unhealthy foods. Of 30 adver-games for children on sites owned by non-CFBAI signatory companies, 16 promoted unhealthy foods, 11 healthy foods, and 3 healthy and unhealthy foods	'There still seems to be a chasm between the industry's expressed intention and its related behavior. . . . Self-regulation is by definition voluntary: companies are not legally compelled to participate and not all do. The participants design guidelines that appear to meet public needs but in reality may be more accurately described as attempts to deflect attention and quiet the industry's critics.' (p. 244)
Roberts *et al.* (2012) (43)	During the 2 months of data collection there were 332 breaches of the voluntary regulations, and 619 breaches of mandatory rules on advertising repetition and the use of promotional appeals and endorsements. Three companies (Coca-Cola, Kraft, Ferrero) advertised during 'C' programming despite reporting they do not market to children <12 years.	'Self-regulation of food advertising by the food industry is falling short of its potential due to coverage of the voluntary codes being limited to signatory companies and inadequate compliance and reporting levels.' (p. 6) 'The self-regulatory systems were found to have flaws in their reporting and there were errors in the Australian Food and Grocery Council's compliance report. . . . Regulations need to be closely monitored and more tightly enforced to protect children from advertisements for unhealthy foods.' (p. 1)
Romero-Fernández *et al.* (2010, 2013) (44,45)	Of 264 food ads aimed at children, 77% were for products from PAOS Code signatories, and of these ads 49 % were non-compliant, plus 21% of uncertain compliance. Among non-signatories, 51% of ads were non-compliant. During 'reinforced protection' time (8:00–9:00 a.m., 5:00–8:00 p.m.) 43% of signatories' ads were non-compliant and 29% of uncertain compliance. Using the UK HFSS model, 60% of the ads were less healthy, 71% during children's protected viewing times and 54% at other times.	'Non-compliance with the PAOS Code was very high and was similar for companies that did and did not agree to the Code, casting doubt on the Code's effectiveness and oversight system.' (2010, p. 1013) [Using the UK HFSS model to regulate food advertising during children's protected viewing times] 'would entail the withdrawal of most food commercials'.
Sixsmith & Furnham (2009) (46)	Child-focused ads contained more health claims, leisure settings, male characters, cartoons and fantasy elements. Compared with non-child-focused ads, child-focused ads were more frequently categorized as promoting 'unhealthy' products, more frequently showed fast food, confectionery and snack foods, and less frequently showed fruits or vegetables.	[During daytime and early evening TV] 'child-focussed advertisements were mainly for convenience foods and snacks which are of considerable interest to health promotion policy makers.' (p. 24)

Table 2 *Continued*

Author (year)	Summary of findings	Authors' conclusion
Speers *et al.* (2011) (47)	Analyses of product placements in TV programs showed that food-related brand appearances were seen by children 281 times. CFBAI signatories accounted for 224 of these brand placements (198 from Coca-Cola). Adolescents saw 444 food-related brand placements, of which 320 were from CFBAI signatories (269 from Coca-Cola). Food-related TV ads were seen by children 4,494 times, of which 2,444 were from CFBAI signatories. For adolescents, 5,352 ads were seen, of which 2,300 were from CFBAI signatories.	'Brand appearances for most food industry companies, except for Coca-Cola, are relatively rare during prime-time programming with large youth audiences. Coca-Cola has pledged to refrain from advertising to children, yet the average child views almost four Coke appearances on prime-time TV every week. This analysis reveals a substantial, potential loophole in current food industry self-regulatory pledges to advertise only better-for-you foods to children.' (p. 291)
Tarcza & Olar (2011) (48)	Foods high in fat and sugar constitute 30% of advertisements seen by children, against 1–5% of advertisements for health-promoting foods. Estimated exposure of children to 90 food advertisements per day. Techniques focus on taste, fun or offers of premiums or competitions. A fifth include a disclaimer (e.g. 'as part of a balanced diet').	'Children of all ages are exposed to a substantial amount of advertising for food and beverages, but their exposure varies significantly by age. Because children 8–12 watch so much television, and therefore see so many food ads, they may be a group most affected by food marketing.' (p. 791)
Government agency and academic reports comparing data before and following statutory regulation or self-regulation		
Brindal *et al.* (2012) (49)	Audience <12 years is never >50% of total audience, and only >35% for 2–5 h weekend mornings. During C-classified programs few non-core foods were advertised. For all TV programming, impacts for non-core foods increased approximately 50% from 2008 to 2010 in children's age groups. Ads by Pledge signatories accounted for 40% of total food ads, and for 63% of non-core food ads before the introduction of the Pledge, rising to 78% of non-core food ads in 2010.	'The impact of non-core food advertising on children has remained consistent since October 2008. Children's programs contain less food advertising than general classified programs. . . . Redefining some of the terms of self-regulatory initiatives to cover a more accurate definition of children's actual viewing times needs consideration to attempt to reduce children's exposure to non-core food advertising.' (p. 13)
Kunkel *et al.* (2009) (50)	Food ads per hour fell from 10.9 (2005) to 7.6 (2009). 'Whoa' products: down from 84% of food ads to 73%. 'Slow' products rose from 13% of food ads to 27%. 'Go' products: down from 3% of food ads to <1%. In 2009, 534 food ads were recorded, of which 29% were from non-CFBAI signatory companies. Non-signatory company ads were 83% 'Whoa' products; signatory company ads were 68% 'Whoa' products, although all 381 ads from signatory companies complied with the companies' own nutrient profile definitions.	'The majority of advertisements from companies participating in the Children's Food and Beverage Advertising Initiative are for nutritionally poor Whoa products, which should only be consumed on special occasions.' (p. 6) 'The data from our study demonstrate that industry self-regulation has achieved only the slightest degree of improvement in televised food marketing to children.' (p. 34)
Ofcom (2010) (52)	100% decline in HFSS ads impacts on children during children's TV, 2005–2009. 37% decline in HFSS ads impacts on children during all TV, 2005–2009. 129% increase in HFSS ad spots during non-children's TV, 2005–2009	[The restrictions] 'have served to reduce significantly the amount of HFSS advertising seen by children'. (p. 5)
Rudd Center (2012) (53)	Age 2–11 years 2011 all food ads: exposure down by 8.4% from 2004, but up by 5.1% from 2007. Rise from 2004 in exposure to ads for: fast food and other restaurants, yogurt, candy. Rise from 2007 in exposure to ads for: fast food and other restaurants, carbonated and non-carbonated beverages, yogurt and dairy, confectionery. Age 12–17 years 2011 all food ads: exposure up by 14.5% from 2004 and up by 27.1% from 2007. Most categories are increasing exposure.	'Total food and beverage advertising seen by children declined 5% in 2011 compared with the previous year. However, children continued to view approximately 13 ads per day that almost exclusively promoted categories of products with little or no nutritional value. Increases in child exposure since 2007 demonstrate that the CFBAI has had limited effect on this unhealthy food advertising landscape.' (p. 6)
Industry-sponsored reports comparing data before and following self-regulation		
Accenture (2012) for IFBA (54)	97.6% compliance: no ads on TV programmes with >50% audience <12 years; 100% compliance: no ads in children's publications; 100% compliance: no ads on child-oriented websites	'Since 2009, the television advertising compliance rate has been above 93% in every market analysed (averaging 98.27% in 2009 and 96% in 2010) and the print and internet advertising compliance rate was 100% in all three years.' (IFBA website)
Advertising Standards Canada (2012) (55)	TV: 92% of food and beverage ads were for CAI-members' products, of which over 80% were for company-defined 'better for you' products, e.g. 'a source of one or more nutrients or essential vitamins'. Print: no members' non-compliance was identified. Adver-games: only 'better for you' products featured.	'In this fourth year of the CAI, Participants' compliance with their respective commitments has been excellent.' (p. 8)
Australian Food and Grocery Council (2012) (56)	In 2011, ads for non-core foods screened during children's programs represented 1.6% of all food and beverage ads shown across eight channels over 24 h. In 2010, the equivalent figure was 3.0%.	'Overall, this study has found that Australian children are exposed to very low levels of non-core food and beverage advertising on television; measured through an assessment of advertisements shown in child-specific programs.' (p. 10)
Kolish & Hernandez (2012) (57)	In 2012, 81% of all food ads were for Pledge-companies' compliant foods (the remainder were for non-Pledge company brands). In 2012, 90% of Pledge companies' ads were for products containing 'food groups to encourage' or a 'good source' of an important nutrient, up from 83% in 2009. In 2012, 72% of Pledge-members' ads were for foods containing at least a half-portion of whole grains or fruit, and 22% were for adds that included non/low-fat milk, yogurt or dairy drinks.	'As with prior years, we found that all participants substantially complied with their pledges.' (p. 14)

Table 2 *Continued*

Author (year)	Summary of findings	Authors' conclusion
EU Pledge (2012) (58)	97–99% compliance: no ads on TV programmes with >35% audience <12 years for pledge-company-defined products; 73% reduction in advertising impacts on children <12 years on TV programmes with >35% audience <12 years, for pledge-company-defined products, compared with 2005; 48% reduction in advertising impacts on children <12 years on all TV programmes for pledge-company-defined products, compared with 2005 29% reduction in advertising impacts on all children <12 years for all pledge-company products, compared with 2005; 95% compliance: no promotion of company-defined products on pledge-company-owned websites 'with particular appeal to children'.	[Monitoring demonstrates] 'a high level of member companies' compliance' [and] 'a significant change in the balance of food advertising to children in the EU towards better-for-you options. . . . However, the compliance monitoring programme for company-owned websites has shown that there is significant room for improvement.' (p. 20)
Forum for Fødevarereklamer (Denmark) (2010)	TRP scores fell from several hundreds to below 10 for most food products, especially chocolate, ice cream and desserts, soft drinks, cereals and cakes, milk products, after 2007.	'Analysen viser, at fødevarer med højt indhold af fedt, sukker eller salt ikke markedsføres omkring TV2's børneprogrammer.' (The analysis shows that foods high in fat, sugar or salt are not marketed during TV2's children's programs.) (p. 8)
UNESDA (2011) (60)	99% compliance: no ads on TV programmes with 50%+ audience <12 years; 100% compliance: no ads in publications with 50%+ audience <12 years; 98–100% compliance: no ads on websites with 50%+ audience <12 years; 96% compliance: no brand-owned websites are likely to attract >50% audience <12 years	[UNESDA members are] 'upholding high levels of compliance with the commitments they made back in 2006'. (p. 7)

GRP, gross rating points; PMV, person-minute-view; TRP, targeted rating point.

statements relevant to the effects of the regulatory or self-regulatory policies in the countries and regions where the surveys were conducted.

Discussion

Two objectives were set for this paper. The first was to summarize the evidence for change in children's exposure to the marketing of food and beverage products, especially ones high in sugar, fats or salt, following the introduction of regulation or self-regulatory pledges. The second objective was to examine the absolute levels of such exposure in recent years.

For the first objective, the papers in peer-reviewed journals, which publish data both before and after the introduction of regulation or self-regulation, indicate that reduction in children's exposure to the most unhealthy products is possible but only occurring in certain circumstances. The non-industry-sponsored reports show only low levels of improvement over the period, although there is stronger evidence for an improvement in the UK and South Korea. In contrast, there is very strong evidence of improvement reported in industry-sponsored reports in many countries.

For the second objective, most of the reports providing exposure data for recent years show exposure similar to that reported in surveys conducted in countries with pre- and post-regulatory information. The implication of this is that the pledges have had only a small or no impact in these countries, as children's exposure levels are not significantly below the levels found elsewhere. Again, the exception to this statement is found in the reports from industry-sponsored bodies, which indicate a very high level of compliance in recent years.

Two major features are apparent: the first is that in several countries or regions children's exposure to food and beverage marketing for unhealthy products can be reduced. Evidence from surveys of French-speaking children in Quebec shows that the ban appears to have an impact in that area, although it is less effective for English-speaking children. In the UK, the data show a 51% reduction in exposure (impacts) to TV advertisements high in fats, sugars or salt (HFSS) during the period 2007–2010 for children aged 5–9 years, and a reduction of 23% for children aged 10–15 years in a wide segment of TV programming. While the number of HFSS advertisements (spots) shown during children's programming fell from 0.3 m in Q1 2005 to virtually zero in 2009, the numbers of advertisements for HFSS foods shown in non-child programming (but still seen by children) rose from 1.4 to 3.2 m in the same period, possibly due to the proliferation of commercial channels over the period.

The second feature is that the industry-sponsored reports have identified very strong evidence of reduced or low levels of exposure, even in countries or regions where other reports or scientific surveys have not found this to be the case. Assuming that their findings are accurate and genuinely reflect the underlying information, the difference must be due to differences in what is being measured. One possible cause of discrepancy may lie in the

lack of complete coverage of the pledges across all food companies: although many of the major companies have signed the pledges, it is possible that advertising from non-pledge members has continued and even increased, but this advertising will not be reported in the industry-sponsored reports that only cover pledge members' advertising activities.

Further potential causes of discrepancy between industry-sponsored reports and other reports may lie in the definitions, as summarized in Table 1, and in particular:

(a) Different audience definitions. Most of the scientific papers used times of day when children are likely to be watching television, whereas the pledges have specified 'children's TV' to be only those TV programmes watched by an audience of which over 35% (or in some cases over 50%) are children under age 12 years. Using such a high percentage of the audience may eliminate most TV programming: an analysis of Australian free-to-air TV watching found no time in weekdays and only a short period at weekends when the proportion of the audience aged under 14 years exceeded 35% (61).

(b) Different nutrient profiling definitions. Each of the peer-reviewed journal papers used a nutrient profiling scheme which was applied across all advertised products, whereas under the voluntary pledge schemes each advertised product is categorized according to definitions developed by the producing company. This raises the risk that company definitions might favour their own products, which would allow them to continue marketing to children a number of products that might be categorized as unhealthy or 'non-core' foods in the surveys reported in the peer-reviewed journals. An example might be found in breakfast cereals: a cereal company categorizes as acceptable to market to children products that contain up to 35 g sugar per 100 g, while a definition of more than 20 g sugar per 100 g makes the cereal a non-core food or high-sugar food in the nutrient profiling schemes adopted in several peer-reviewed papers.

These potential differences in definitions may account for the discrepant results. However, the industry-sponsored reports also indicate that exposure of children to TV advertising at all times of day and to all products made by the food companies has also fallen significantly in terms of impacts, either due to a reduction in the actual number of advertisements shown or a dilution of the impact by spreading across an increased number of channels available. These potential differences have policy implications and need to be further researched.

It should be noted here that the review undertaken for this paper was limited to papers and reports available in the English language. We recognize that reports in other languages may show a different pattern of results. The IFBA commitment covers the globe, and it may have achieved more substantial effects in some regions than others, which might be shown in independent surveys of which we are not aware.

Although TV advertising dominates the regulatory scene, there is evidence of a significant redirection of expenditure towards advertising and brand promotion through other media (although here it should be noted that reduced expenditure on TV advertising may in part be due to reduced costs of advertising on TV). Trends in online advertising expenditure (for all goods and services, including food and beverage products) in the three leading European markets (France, Germany, UK) have shown a dramatic increase in the period 2000–2010 from a total of less than €0.5bn to over €10bn, while in the United States the figure exceeds $39bn (62). In the UK, online advertising expenditure was reported to have exceeded expenditure on television advertising for the first time in early 2009 (63) and is likely to do so in the United States by 2018.

Online advertising includes advertising within search engines and 'pop-up' advertising, but this is by no means the only form of digital media being exploited for product promotion. The use of social networking sites for advertising and brand promotion has also increased rapidly: global expenditure on advertising on social networking sites reached an estimated $US5.5bn in 2011 and is predicted to reach $US10bn annually by 2013 (64). The use of social media for marketing is founded on evidence that it can increase advertisement recall, awareness of the product or brand and purchase intent (65). With 56,000 new fans joining it daily, Coca-Cola's fan page was rated the 11th most popular in the world in mid-2011, with a total of nearly 32 million 'fans' (66). It was the only food-related product with such a high ranking, the next-placed product being Starbucks with 23 million fans, having gained 13 million in a year (67). Although some social media sites require users to declare their age as being over 13 years, there is good evidence that younger children routinely access these sites: 33% of children aged 8–12 years in the UK have a profile on Facebook or on a similar site with a hypothetical 13 years of restriction (68).

The emergence of new media channels which can directly access children raises further concerns about the nature of regulations needed to control exposure of children to unhealthy food marketing. There is recognition that company-owned websites should be included in pledges, but less recognition of the use of social networking sites, smart-phone apps, downloadable adver-games, or the cross-branding of healthier food and beverage products and non-food products with unhealthy food-related brand identities, or marketing in school and other child-friendly settings. Similarly, self-regulation does not generally include retail displays and in-store promotion, product design and formulation, or product labelling and packaging – and in particular it does not cover the use of licensed

characters and tie-in characters from TV shows and cinema films being used on product packaging, a marketing strategy which not only serves to attract attention to the product in the retail setting but also to promote the food product by association when the characters are then seen in TV shows, films and videos.

Conclusion

This paper sets out to summarize the effects of regulation and self-regulation, including the voluntary pledges made by food and beverage companies, supposedly designed to implement policies to reduce children's exposure to the promotion of less healthy food and beverage products. It finds a heterogeneous set of results. Surveys reported in papers in peer-reviewed journals provide evidence of continuing high levels of promotion of less healthy food products and high levels of exposure of children to this promotion, with small or no reductions over recent years in many locations except in response to statutory regulation. Reviews of other reports show a distinct division between industry-sponsored reports which indicate a remarkable reduction in the promotion of unhealthy products and children's exposure, and reports from a variety of other authoritative sources which show weak or absent reductions, or insufficient evidence of change as a result of the self-regulation, but some reduction following statutory regulation. These latter reports imply that statutory regulation may have the potential to reduce children's exposure significantly, but are currently insufficient to cover the full range of opportunities for marketing to children.

We recognize the remarkable efforts that have been made by many food and beverage companies to reduce their marketing of some of their products directly to children, and that new nutrient profiling schemes and new definitions of children's programming have been offered by the pledge members for implementing in 2013 or 2014. However, the narrow range of media, the weak definitions of marketing, the absence of many large food companies and the lack of enforceability or penalties for failure suggest that self-regulatory pledges are unlikely to be sufficiently comprehensive to have the desired effect of reducing children's exposure to promotional marketing of unhealthy food products unless tied to stronger government oversight. Comprehensive, preferably statutory measures are recommended, with adequate monitoring of compliance and adequate sanctions for non-compliance, and based on government-led definitions of the media to be covered, the products to be controlled and the audience to be protected.

Conflict of Interest Statement

The authors declare no conflicting interests with respect to this paper.

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