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A comparison of self-reported exposure to fast food and sugary drinks marketing among parents of children across five countries

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ABSTRACT

Exposure to unhealthy food and beverage marketing is an important environmental determinant of dietary intake. The current study examined self-reported exposure to marketing of unhealthy foods and beverages across various media channels and settings among parents of children younger than 18 years in five high and upper-middle income countries. Data from 4827 parents living with their children were analyzed from the International Food Policy Study (2017), a web-based survey of adults aged 18–64 years from Canada, the United States (US), the United Kingdom (UK), Australia, and Mexico. Respondents reported their exposure to marketing of fast food and of sugary drinks across media channels/settings overall and how often they see fast food and sugary drink marketing while viewing media with their children. Regression models examined differences across countries and correlates of marketing exposure. Parents in Mexico and the US reported greater exposure to marketing for fast food and sugary drinks compared to parents in Australia, Canada, and the UK. Patterns of exposure among parents were generally consistent across countries, with TV, digital media, and radio being the most commonly reported media channels for both fast food and sugary drinks. Exposure to marketing of fast food and sugary drinks was associated with a variety of sociodemographic factors, most strongly with ethnicity and education, and sociodemographic trends differed somewhat between countries. The findings demonstrate differences in self-reported parental exposure to marketing of fast food and sugary drinks between countries, and may help to evaluate the impact of marketing restrictions implemented over time.

1. Introduction

Globally, the prevalence of excess weight and other diet-related noncommunicable diseases continue to increase. In 2015, excess weight affected approximately 30% of the world's population, or approximately 2 billion children and adults, with significant variation in overweight and obesity rates between countries (GBD Obesity Collaborators, 2017). Systems-level influences of the food environment on eating behaviours are increasingly recognized as significant contributors to the obesity epidemic (Glanz et al., 2005; Swinburn et al., 2011). Exposure to food and beverage marketing has been identified as a key determinant of diets among children and youth (Kraak et al., 2006), and has been associated with children's food preferences, consumption patterns, and purchase requests (Kraak et al., 2006; Hastings et al., 2014; Cairns et al., 2013). There is also evidence linking exposure to food marketing with the food choices and consumption patterns of adolescents (Kraak et al., 2006; Scully et al., 2012; Pearson et al., 2014) as well as of adults (Harris et al., 2009).

Policies that restrict the marketing of foods and beverages are garnering increased attention and are encouraged by the World Health Organization (World Health Organization, 2012). Regulations restricting marketing to children protect the environment in which children acquire food preferences, and encourage the development of preferences for healthy foods (Hawkes et al., 2015). Mandatory restrictions on marketing unhealthy foods have been introduced in more than a dozen

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Abbreviations

US: United States
UK: United Kingdom
IFPS: International Food Policy Study
CFS: Canada Food Study

jurisdictions (Taillie et al., 2019), as voluntary industry-led pledges to restrict advertising of unhealthy foods and beverages to children have shown little to no evidence of effectiveness (World Cancer Research Fund, 2014). While marketing restrictions typically apply to advertisements or media that are targeted at or appeal to children, they may also influence exposure to advertising among adults. The critical role that parents play in food purchasing and preparation, as well as in shaping household food preferences, has been well established (Kraak et al., 2006; Hawkes et al., 2015; Yee et al., 2017). Thus, parental exposure to unhealthy food marketing overall and when viewing media channels alongside their children, is of interest.

Monitoring population-level exposure to food and beverage marketing is needed to understand the nature and extent of this critical aspect of the food environment, and to inform the development of effective policy interventions (Glanz et al., 2005; Kelly et al., 2013; World Health Organization, 2016). In addition to commercial food advertising in traditional media such as television, research increasingly examines other forms of food marketing, including in child-based settings, digital media, print media, outdoor advertising, on product packaging, and through sponsorship (Kelly et al., 2013). However, most efforts to date have been limited by their examination of a single media channel and are conducted among small population samples (Kelly et al., 2013), and most comparative reviews and evidence syntheses have relied on data collected using varying methods and approaches, impeding direct comparison of results (Taillie et al., 2019). A broader evidence base extending across various media channels and populations is needed to establish a more comprehensive picture of food marketing exposure and to evaluate the impact of policy interventions (Hawkes et al., 2015). Additionally, marketing exposure can be assessed using different methodologies, including direct observation (e.g., the use of cameras (Signal et al., 2017; McKerchar et al., 2020), recording software (Potvin Kent et al., 2019), or 'event momentary assessments' (Hébert et al., 2017)), objective data on advertising expenditures or viewership estimates within media types (e.g., gross rating points) (Czoli, 2020), and methods that employ self-report (Kumar et al., 2015; Hammond and Reid, 2018; Forde et al., 2019). Objective exposure data within countries suggests that children's exposure to food marketing data is substantial, particularly in high and middle-income countries and increasing in digital environments (Bragg et al., 2020). Few studies have examined how consumers recall and report exposure to unhealthy food marketing across channels.

Various policy approaches have been taken to restrict marketing to children (Taillie et al., 2019). The current study was conducted across five upper and upper-middle income countries with varying approaches to the regulation of the marketing of unhealthy foods to children (Australia, Canada, Mexico, the United Kingdom (UK), and the US). In Canada, commercial marketing directed at children under 13 years has been restricted in the province of Quebec since 1978 (Government of Quebec, 1978). In the UK, the 2010 UK Code of Broadcast Advertising prohibits advertising and product placement of foods high in fats, sugars and salt, during and adjacent to television and radio programs that appeal to youth under the age of 16 years, and a 9 pm watershed ban on junk food advertising that would prohibit any junk food advertising on television before 9 pm and, more recently, a total ban on online advertising of foods high in fat, sugar and salt in the UK have been proposed, subject to public consultation (Department of Health and Social Care: Global and Population Health Obesity Food and Nutrition Resource Centre, 2019; Department of Health and Social Care and Department for Digital C, Media, and Sport, 2020). In Mexico, restrictions on advertising unhealthy foods and beverages on television programs where over 35% of the audience is under the age of 13 years were implemented in 2014 (World Cancer Research Fund, 2014; Obesity Policy Coalition, 2018a). In Australia (Obesity Policy Coalition, 2018b), Canada (outside of Quebec) (Advertising Standards Canada, 2021), and the US (Council of Better Business Bureaus, 2017), restrictions on marketing unhealthy foods to children have primarily relied on voluntary industry-led commitments, largely focused on children 12 years and under and generally applied to broadcast media. Recently, Canada and the UK announced plans to develop national regulations which aim to restrict the marketing of unhealthy foods and beverages to children via different all media and digital channels, respectively (Health Canada, 2016; Government of Canada, 2019). This study aimed to understand the self-reported frequency of exposure to marketing for fast food and sugary drinks via various media channels among parents, overall and when co-viewing TV, movies or online content with their children in countries with various policy environments.

2. Methodology

Data were from the International Food Policy Study (IFPS) 2017 data collection, conducted in Australia, Canada, Mexico, the UK and the US. IFPS data were collected via self-completed web-based surveys conducted in November/December 2017 with adults aged 18–64 recruited through Nielsen Consumer Insights Global Panel and their partners' panels. Email invitations were sent to a random sample of panelists (after targeting for age and country criteria). Surveys were conducted in English in Australia and the UK; Spanish in Mexico; English or French in Canada; and English or Spanish in the US. All Canadian respondents aged 18–30 and some aged 31 and 32 were recruited from the Canada Food Study (CFS), a parallel longitudinal survey using in-person recruitment strategies from five Canadian cities in 2016, whereby potential respondents were approached in public spaces using standard intercept techniques. The pairing of IFPS and CFS data was decided a priori due to funding constraints. Recruitment sites were systematically identified using an established sampling frame, stratified by city region/neighbourhood and type of site (mall, transit hub, park, or other shopping district) in 3–5 regions in each city (Hammond et al., 2019). Several minor differences between the IFPS and CFS samples among those aged 18–32 years (a smaller percentage of low education participants, slightly more participants who identified as an ethnic minority, lower rates of obesity but greater rates of overweight in the CFS compared to the IFPS). Sensitivity analyses reveal that there were negligible differences in logistic regression outcomes when CFS sample was excluded, and thus the sample was retained in analyses (data not shown). For the current study these respondents were recontacted and sent a unique survey link to complete the online survey. A full description of the study methods for the IFPS are available in the Technical Report (Hammond et al., 2018).

All respondents provided consent prior to completing the survey and received remuneration in accordance with their panel's usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes). The study was reviewed by and received ethics clearance through a University of Waterloo Research Ethics Committee (ORE# 21460 for the IFPS and ORE# 30893 for the CFS).

2.1. Measures

2.1.1. Exposure to sugary drink and fast food marketing across various marketing channels

Self-reported exposure to fast food and sugary drink marketing was assessed using two approaches, adapted from other research areas including tobacco (Southwell et al., 2002; Feighery et al., 2006; Davis et al., 2016; McAfee et al., 2017; Yong et al., 2008) and vaping

(Wadsworth et al., 2018). First, overall exposure to fast food marketing among parents was examined across various marketing channels and settings using the measure: "*In the last 30 days, have you seen or heard any advertisements or promotions for fast food in the following places?*". Participants could select as many of the following options that applied: TV ads; radio ads; online/internet ads (including YouTube); mobile app/video game; social media (e.g., Twitter, Facebook, Snapchat); in a text message; magazine or newspaper; billboard or outdoor sign (e.g., posters, transit ads); in movies; at school/on campus; signs or displays in stores or restaurants; at a recreation/community centre; sports event or sponsorship (e.g., logos or links with events, teams or athletes); giveaways, samples or special offers; other (open-ended response). Given that the responses were not mutually exclusive (e.g, online / internet ads (including YouTube) incorporates YouTube, which is commonly viewed as a type of social media), exposure to online/internet ads, mobile app/video game, social media, and text messages were grouped as "digital media". Open-ended responses were classified into the 11 marketing channels. Participants could also select "I haven't seen any marketing for fast food in the last 30 days", "don't know" or "refuse to answer". A parallel measure examined exposure to sugary drinks marketing across marketing channels, and included the following explanatory preamble: "*Sugary drinks are drinks that contain added sugar, like pop (Australia: soft drinks; UK: fizzy drinks), fruit drinks, sports drinks, energy drinks, chocolate milk, and specialty coffees that have added sugar*".

2.1.2. Level of marketing exposure while co-consuming video-based media

Second, exposure to fast food marketing among parents while co-consuming TV, video or movies (i.e., video-based media) with their children under 18 years was examined using the measure: "*In the last 30 days, when watching TV, videos, or movies with your children, how often did you see or hear advertisements for fast food restaurants?*" (response options: "not at all", "rarely", "sometimes", "often", "all the time", "I haven't watched TV, videos, or movies with my children in the last 30 days", "don't know" or "refuse to answer"). Video-based media were selected as they were believed to be the media type most commonly co-viewed by parents and children. A parallel measure was used to examine exposure to marketing of sugary drinks, replacing "*fast food restaurants*" with "*sugary drinks, like pop (Australia: soft drinks; UK: fizzy drinks), fruit drinks, sports drinks, or energy drinks?*", with the same response options.

2.1.3. Socio-demographic measures

Sociodemographic data collected included parental age, sex, education, ethnicity, and body mass index (BMI). Age was used as a continuous variable. Sex at birth was measured as a binary variable (*male* or *female*). Education and race/ethnicity were assessed with census measures from each country and re-coded to derive comparable measures across countries: *low, medium,* or *high* education, and *majority* or *minority* ethnicity (Statistics Canada, 2013; Instituto Nacional de Salud Pública, 2016; UK Data Service (Household questionnaire England: 2011 census), 2021; Centers for Disease Control and Prevention, 2016; International Tobacco Control Policy Evaluation Project, 2009; Statistics Canada, 2018; Office for National Statistics, 2016). Parental BMI was calculated using self-reported height and weight, and classified according to World Health Organization criteria (World Health Organization, 2017), recategorized into *underweight or normal weight, overweight, obesity,* or *not reported*. *Underweight* and *normal weight* were combined given low levels of respondents reporting 'underweight' (Canada = 1.2%, Australia = 2.1%, UK = 3.4%, USA = 2.7%, Mexico = 1.4%), which lead to problems of model convergence in the multivariate analyses. Sensitivity analyses reveal negligible differences in model outcomes when underweight was excluded from this category (data not shown). In addition, there are potentially important differences among those who do not report their height and weight in population-level surveys, as the literature suggests that individuals who don't respond to height and weight measures may also have greater likelihood of other comorbidities (Read et al., 2017). As such, those with missing data for height and weight were included in the sample. Specific wording for sociodemographic measures in each country is available (Hammond et al., 2018).

2.2. Analysis

A total of 25,692 adults completed the IFPS survey: 6814 (26.5%) respondents were removed for missing data on key socio-demographics or poor data quality (incorrect response to a multiple-choice question regarding the current month or survey length < 15 min), and 18,878 were retained in the overall sample. An additional 979 participants aged 18–32 recruited from the CFS were added to the IFPS sample for a total of 19,857 participants (Australia: $n = 3767$; Canada: $n = 3118$; Mexico: $n = 4057$; United Kingdom: $n = 4047$; United States: $n = 4868$). The current analysis was limited to parents living with their children aged 0–17 years ($n = 5036$, 25.4% of total sample). After excluding participants with missing data within the models (education: $n = 30$, ethnicity: $n = 46$, and BMI: $n = 133$, overall 4.2% of parent sample), a total of 4827 participants ($n = 23$ from the CFS) were included in the final analytic subsample. Data were weighted with post-stratification sample weights constructed using population estimates from the census in each country based on age, sex and region. All estimates reported herein are weighted.

Regression models were constructed for two primary outcomes (parental exposure to media across each channel and overall, as well as when consuming media with their children), including an indicator variable for country and adjusting for age, sex, ethnicity, education, and parental BMI. Logistic regression examined the likelihood of exposure to each channel individually. Exposure to fast food/sugary drinks marketing among parents across all media channels was modelled as a count variable, summing the number of media channels to which participants were exposed for a maximum of 11 channels. Negative binomial regression models were constructed as appropriate for a count outcome with a large number of zeros and variance greater than the mean. Exposure to fast food/sugary drinks marketing when co-consuming video-based media was modelled as a continuous variable (1="not at all", 2 = "rarely", 3 = "sometimes", 4 = "often", and 5="all the time") using linear regression models. Differing sociodemographic patterns between countries were tested by examining two-way interactions of country with age, sex, ethnicity, education, and parental BMI. Statistical significance was adjusted using the Benjamini-Hochberg method with a conservative false discovery rate of 0.05 to account for multiple comparisons within models. Analyses were conducted using SPSS (v. 27).

3. Results

Characteristics of the sample of parents living with their children across five countries are presented in Table 1. There were differences between countries in all demographic variables, with fewer young adults in Canada and more participants with high levels of education in US and Mexico.

3.1. Number of marketing channels where parents were exposed to food and beverage marketing

Exposure to marketing of fast food and sugary drinks across various media channels and settings is shown in Table 2. The most commonly reported media channels to which parents reported being exposed across all countries included TV (range 43–76% for fast food, 36–78% sugary drinks) and digital media (range 30–60% for fast food, 38–78% for sugary drinks). There were differences in exposure between countries for all media channels except for giveaways, offers and specials for fast food (Table 2). In most countries for both fast food and sugary drinks, exposure to all channels other than television was similar to exposure via television.

Fig. 1 shows the mean number of marketing channels to which parents reported exposure to fast food and sugary drinks marketing

Table 1
Sample characteristics of parents living with their children in five countries (weighted) $N = 4827$.

Characteristic	Weighted ($N = 4827$)					Pearson X^2 (p value)
	Australia ($n = 881$)	Canada ($n = 407$)	Mexico ($n = 1343$)	UK ($n = 1207$)	US ($n = 989$)	
	% (n)					
Age [years]						
18–30	17 (149)	4 (15)	23 (309)	20 (246)	16 (161)	771 (<0.0001)
31–39	38 (335)	41 (167)	29 (395)	35 (422)	41 (406)	
40–49	34 (302)	43 (173)	33 (448)	32 (383)	33 (323)	
50–64	11 (95)	13 (52)	14 (191)	13 (156)	10 (99)	
Sex						
Male	46 (401)	48 (197)	45 (608)	42 (512)	46 (457)	47 (<0.0001)
Female	54 (480)	52 (210)	55 (735)	58 (695)	54 (531)	
Education						
Low	22 (191)	12 (50)	14 (189)	24 (285)	17 (167)	
Medium	37 (322)	36 (146)	11 (142)	29 (347)	17 (167)	
High	42 (368)	52 (211)	75 (1012)	48 (575)	66 (654)	
Ethnicity						
Majority group	79 (697)	68 (276)	84 (1130)	89 (1071)	50 (490)	1293 (<0.0001)
Minority group	21 (184)	32 (131)	16 (213)	11 (1376)	50 (500)	
BMI						714 (<0.0001)
Underweight or normal weight	41 (362)	38 (153)	41 (547)	35 (423)	37 (365)	
Overweight	26 (231)	32 (130)	36 (486)	22 (260)	33 (323)	
Obesity	17 (152)	19 (76)	21 (276)	13 (152)	22 (217)	
Not reported	15 (135)	12 (48)	2 (33)	31 (372)	8 (84)	

Table 2
Percentage (n) of parents exposed to marketing of fast food and sugary drinks in five countries, by marketing channel ($N = 4827$)[1,2].

Marketing channel	Fast food					Sugary drinks				
	Australia ($n = 881$)	Canada ($n = 407$)	Mexico ($n = 1343$)	UK ($n = 1207$)	US ($n = 989$)	Australia ($n = 881$)	Canada ($n = 416$)	Mexico ($n = 1343$)	UK ($n = 1207$)	US ($n = 989$)
	% (n)									
Television (TV)	51 (446)^{a,b}	43 (176)^{a}	76 (1027)^{c}	51 (618)^{b}	62 (644)^{d}	36 (314)^{a}	39 (160)^{a}	78 (298)^{b}	38 (464)^{a}	55 (541)^{c}
Digital media[3]	31 (276)^{a}	30 (121)^{a}	60 (806)^{b}	32 (387)^{a}	50 (498)^{c}	25 (218)^{a}	23 (93)^{a}	59 (797)^{b}	24 (293)^{a}	45 (445)^{c}
Radio	21 (183)^{a}	22 (91)^{a,b}	36 (439)^{c}	14 (164)^{d}	37 (369)^{c,e}	9 (78)^{a}	8 (32)^{a}	27 (362)^{b}	9 (109)^{a}	23 (226)^{c}
Billboards or outdoor signs	16 (141)^{a}	21 (84)^{a}	37 (502)^{b}	20 (238)^{a}	29 (283)^{c}	11 (95)^{a}	14 (56)^{a}	35 (468)^{b}	12 (143)^{a}	18 (180)^{c}
Signs or displays in stores or restaurants	11 (93)^{a}	16 (64)^{a,b}	32 (431)^{c}	11 (135)^{a}	21 (209)^{b}	13 (118)^{a}	21 (84)^{b}	39 (524)^{c}	10 (121)^{a,d}	24 (235)^{b}
Magazines or newspapers	11 (95)^{a}	12 (50)^{a,b}	30 (403)^{c}	14 (163)^{b}	24 (232)^{d}	9 (80)^{a}	12 (48)^{a}	30 (396)^{b}	10 (123)^{a}	20 (196)^{c}
Sports events or sponsorship	7 (61)^{a}	8 (34)^{a}	13 (179)^{b}	5 (61)^{a}	15 (145)^{b}	7 (61)^{a}	11 (46)^{b}	26 (351)^{c}	7 (80)^{a,b}	18 (179)^{d}
Movies	6 (51)^{a}	7 (27)^{a,b}	25 (341)^{c}	5 (59)^{a}	11 (109)^{b}	7 (64)^{a,b}	12 (48)^{a,c}	32 (433)^{d}	5 (58)^{b}	18 (181)^{e}
Giveaways, samples, special offers	4 (33)	6 (24)	4 (50)	3 (34)	5 (51)	3 (29)^{a}	3 (14)^{a}	7 (91)^{b}	3 (39)^{a}	4 (42)^{a,b}
Recreation/ community centre	3 (28)^{a}	3 (12)^{a}	8 (111)^{b}	2 (23)^{a}	5 (45)^{a}	3 (23)^{a}	5 (24)^{a,b}	9 (123)^{b}	2 (25)^{a}	4 (39)^{a}
School/campus	5 (20)^{a,b,c}	3 (12)^{a,d,e}	8 (108)^{f}	2 (18)^{b,d}	4 (41)^{c,e}	1 (12)^{a}	2 (11)^{a,c}	9 (127)^{b}	3 (30)^{a}	5 (52)^{c}
All channels except TV	47 (426)^{a}	53 (214)^{a}	79 (1065)^{b}	49 (595)^{a}	69 (696)^{c}	39 (356)^{a}	44 (183)^{a}	78 (1087)^{b}	39 (474)^{a}	63 (612)^{c}
Other	0.1 (1)	0 (0)	0.1 (2)	0.3 (3)	0.5 (5)	0.6 (5)	0 (0)	0.1 (1)	0.2 (2)	0.1 (1)
None	28 (242)^{a}	29 (117)^{a}	7 (98)^{b}	27 (328)^{a}	14 (141)^{c}	41 (359)^{a}	38 (152)^{a}	8 (110)^{b}	36 (440)^{a}	20 (198)^{c}
Don't know	5 (46)^{a}	6 (24)^{a}	0.2 (3)^{b}	5 (63)^{a}	2 (20)^{b}	7 (64)^{a}	6 (26)^{a}	0.5 (7)^{b}	8 (92)^{a}	4 (41)^{a}
Refused	0.1 (1)	0 (0)	0 (0)	0 (0)	0.1 (1)	0.1 (1)	0.1 (1)	0 (0)	0.1 (1)	0.1 (1)

Abbreviations: CAN=Canada, AUS = Australia, UK=United Kingdom, US=United States, MEX = Mexico.

[1] Participants could select all that apply.

[2] Alphabetical superscripts with different letters indicate significant differences between countries for between-country differences in logistic regression models for each media channel, adjusted for age, sex, education, ethnicity and BMI after the Benjamini-Hochberg method has been applied using a conservative false discovery rate of 0.05.

[3] 'Digital' includes exposure from online / internet ads, mobile app/video game, social media, and via text messages.

across countries, which ranged from 1.55 channels (UK) to 3.28 channels (Mexico) for fast food and 1.23 (UK) and 3.51 (Mexico) for sugary drinks. Estimates from separate negative binomial regression models examining exposure to fast food and sugary drinks marketing channels across countries are presented in Table 3. The number of channels through which parents were exposed to fast food marketing differed by country, and BMI. Parents living in Mexico reported exposure to more media channels and settings marketing fast food compared with those living in all other countries; and parents in the US reported exposure to more channels compared to those in Australia, Canada and the UK. With

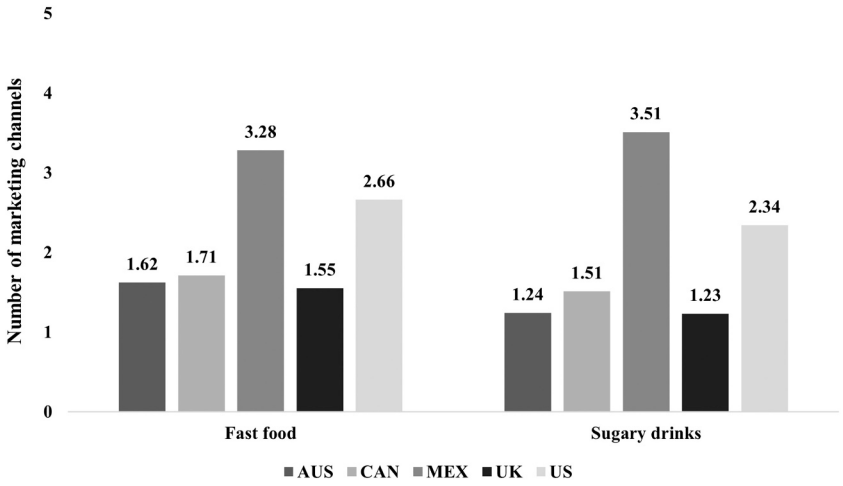

Fig. 1. Exposure to marketing for fast food and sugary drinks among parents in five countries: Mean number of marketing channels (N = 4827)[a].
Abbreviations: AUS = Australia, CAN = Canada UK=United Kingdom, US = United States, MEX = Mexico.
[a] Range of 0 to 11 possible channels.

respect to BMI, parents who reported their height and weight (any BMI category) reported exposure to a greater number of fast food marketing channels and settings than parents that didn't report BMI. Few differential patterns by country were identified (Supplementary Table 1): there was a greater age differential in Canada compared to Australia, and females (compared to males) were exposed to more channels in Mexico compared to Canada and in the US compared to the UK.

Analyses indicated that sugary drinks marketing exposure among parents differed by country, education, ethnicity and BMI (Table 3). Parents living in Mexico reported exposure to a greater number of media channels or settings marketing sugary drinks compared to those living in all other countries; parents in the US reported exposure to a greater number of channels compared to those in Australia, Canada, and the UK; and parents in Canada and the UK reported exposure to a greater number of sugary drinks marketing channels than parents in Australia. Across countries, those from minority ethnicity groups and those with a medium level of education (compared to low) reported exposure to a greater number of media channels and settings marketing sugary drinks. With respect to BMI, parents classified as underweight or normal weight, overweight, and with obesity all reported exposure to more media channels and settings marketing sugary drinks compared to parents that did not report their height and weight. In addition, those classified as having obesity reported exposure to a greater number of marketing channels than those classified as under/normal weight or overweight. Again, few differential patterns were observed (Supplementary Table 2): exposure to a greater number of channels was reported among older Mexican parents compared to Australia and UK, and older Canadian parents compared to Australia, US and the UK. Furthermore, males (compared to females) reported fewer exposure channels in the US compared to Australia, Canada and the UK, and those who identified as an ethnic minority in the US reported more exposure channels than those in Canada and the UK.

3.2. *Level of marketing exposure while co-consuming video-based media*

Fig. 2 shows the mean rate of marketing exposure as reported by parents while viewing TV, videos, and movies with their children, with greater numbers representing increased reported frequency of exposure to fast food and sugary drink advertising. In all countries except Mexico, parents reported more frequent exposure to marketing of fast food than sugary drinks when co-consuming video-based media with their children. The distribution of responses in each country are presented in Supplementary Fig. 1 and 2. Parents most commonly report 'sometimes' seeing advertisements for fast food and sugary drinks while co-consuming video-based media with their children.

Estimates from separate linear regression models examining rates of exposure to fast food and sugary drinks marketing when co-consuming video-based media with their children across countries are presented in Table 4. Self-reported exposure to fast food marketing among parents while co-consuming media with their children differed significantly by country and ethnicity. With respect to differences across countries, more frequent exposure while co-consuming video-based media with their children was reported among parents in: Mexico compared to all other countries; in the US compared to the UK, Canada, and Australia; and in Australia compared to Canada. Overall, self-reported exposure to fast food marketing while co-consuming media with their children was higher among parents who identified as ethnic minorities. There were differential patterns between countries detected for age and ethnicity, such that older Canadian parents reported more frequent exposure compared to Mexico and the UK, and those who identified as ethnic minorities reported less frequent exposure in Mexico compared to Australia and the UK (Supplementary Table 3).

Similarly, self-reported exposure to sugary drinks marketing when parents were co-consuming video-based media with their children differed significantly by country, age, and ethnicity (Table 4). With respect to differences across countries, more frequent exposure was reported by parents living in: Mexico compared to all other countries; in the US compared to the UK, Canada, and Australia; and in the UK compared to Canada. Overall, greater exposure to sugary drink marketing while co-viewing video-based media was reported by parents who were older and who identified as ethnic minorities. There were differential patterns between countries for ethnicity only, whereby those who identified as an ethnic minority in the US reported more frequent exposure compared to those in Mexico (Supplementary Table 4).

4. Discussion

The study findings demonstrate differences in self-reported exposure to marketing of unhealthy foods and beverages across countries. Parents living in Mexico and the US consistently reported greater exposure to marketing for fast food and sugary drinks, compared to parents in Canada, Australia, and the UK. Notably, findings from the current study did not show markedly lower food and beverage marketing exposure when parents were co-viewing video-based media in the UK or Mexico, despite the presence of regulatory restrictions in these jurisdictions (World Cancer Research Fund, 2014), nor did the results suggest increased exposure to advertising via non-television media channels as a way to compensate for regulatory restrictions on television advertising.

Table 3
Estimates from separate negative binomial regression models examining exposure to fast food and sugary drink marketing (by number of marketing channels) among parents in five countries ($n = 4784$).

Parameter	Fast food marketing		Sugary drinks marketing	
	Wald χ^2 (*p*-value)	IRR (95% CI)	Wald χ^2 (*p*-value)	IRR (95% CI)
Intercept	268.83 (<0.001)*		285.95 (<0.001)*	
Country	363.90 (<0.001)*		533.83 (<0.001)*	
AUS vs. US		2.74 (2.27,3.31)*		2.85 (2.38,3.41)*
AUS vs. MEX		5.11 (4.22,6.19)*		9.75 (7.92,12.02)*
AUS vs. UK		1.12 (0.97,1.29)		1.18 (1.04,1.24)*
AUS vs. CAN		1.15 (0.96,1.38)		1.35 (1.14,1.60)*
CAN vs. US		2.38 (1.92,2.95)*		2.11 (1.71,2.61)*
CAN vs. MEX		4.44 (3.55,5.54)*		7.23 (5.70,9.16)*
CAN vs. UK		0.97 (0.81,1.17)		0.88 (0.74,1.04)
UK vs. US		2.45 (2.02,2.96)*		2.41 (2.00,2.91)*
UK vs. MEX		4.56 (3.76,5.54)*		8.25 (6.68,10.19)*
US vs. MEX		1.87 (1.49,2.33)*		3.42 (2.69,4.36)*
Age	0.06 (0.81)	1.00 (0.99,1.07)	1.04 (0.31)	1.00 (0.99,1.00)
Sex	0.19 (0.66)		3.86 (0.05)	
Male vs. female		0.98 (0.87,1.09)		0.90 (0.81,1.00)
Education	4.04 (0.13)		8.72 (0.013)*	
Low vs. medium		1.16 (0.99,1.36)		1.24 (1.08,1.44) *
Low vs. high		1.05 (0.91,1.20)		1.12 (0.98,1.27)
High vs. medium		1.11 (0.98,1.27)		1.11 (0.98,1.26)
Ethnicity	2.12 (0.15)		4.37 (0.04)*	
Majority vs. minority		1.11 (0.96,1.28)		1.16 (1.01,1.33)*
BMI	101.17 (<0.001)*		67.19 (<0.001)*	
Under/normal weight vs. overweight		1.08 (0.93,1.25)		0.98 (0.85,1.12)
Under/normal weight vs. Obesity		1.20 (1.01,1.42)		1.20 (1.02,1.42) *
Under/normal weight vs. not reported		0.55 (0.48,0.64)*		0.64 (0.56,0.73) *
Overweight vs. Obesity		1.11 (0.93,1.33)		1.23 (1.03,1.47) *
Overweight vs. not reported		0.51 (0.44,0.60)*		0.65 (0.56,0.76)*
Obesity vs. not reported		0.46 (0.38,0.55)*		0.53 (0.45,0.63)*

Abbreviations: CAN = Canada, AUS = Australia, UK = United Kingdom, US = United States, MEX = Mexico; IRR = Incidence rate ratio; CI = Confidence interval.

Notes: Negative binomial: 0.426 (fast food); 0.595 (sugary drinks). The variable listed first is the reference variable.

* Indicates that confidence intervals remain significant after adjustment for Benjamini-Hochberg procedure using a conservative false discovery rate of 0.05.

However, it has been acknowledged that neither of these sets of regulations are comprehensive, and to date, evaluations of the UK regulations have shown little to no change in marketing exposure among children (Boyland et al., 2011; Adams et al., 2012). In addition, it may also be possible that marketing exposure in these countries was even greater prior to the implementation of regulations. Nevertheless, these data may serve as a benchmark for monitoring and evaluation of forthcoming food and beverage marketing policies, such as the proposed statutory regulations proposed in Canada and the UK.

The study findings reflect the prominence of fast food and sugary drinks marketing across jurisdictions, in accordance with other international comparisons (Kelly et al., 2019). The relative frequency of types of media channels to which exposure was reported were fairly consistent across countries, with television always ranking the highest, followed by digital media. The predominance of television as a channel for food and beverage marketing indicates that, despite the diversification of media consumption in recent years (Kelly et al., 2015), television remains a critical channel of marketing exposure. While many studies have assessed commercial food marketing exposure on television (Adams et al., 2012; Kelly et al., 2019; Potvin Kent et al., 2014; Potvin Kent et al., 2011; Kelly et al., 2010), evidence for other media (e.g., social media (Potvin Kent et al., 2019)) and other types of marketing (e.g., sports sponsorship (Bragg et al., 2018a; Bragg et al., 2018b), celebrity endorsements (Bragg et al., 2016)) is more limited, and comparative analyses across marketing channels are lacking.

To date, several previous studies have shown socioeconomic disparities in patterns of food and beverage marketing frequency and exposure, typically using measures of social position and race (Backholer et al., 2021). Building upon this research, the current findings identified ethnicity as an independent predictor of the frequency of exposure to marketing of both fast food and sugary drinks when parents co-viewed programs with children. The impact of ethnicity and race varied somewhat across countries, and the relationship between higher exposure to marketing among ethnic minorities was particularly high in the US. While it is unclear whether differences in the reported marketing exposure are due to differences in the volume of marketing targeting particular groups (Bragg et al., 2019; Powell et al., 2014) or differences in the volume of media consumed by particular groups (Swindle et al., 2014; Fleming-Milici and Harris, 2018), these differences in marketing exposure may be contributing to socioeconomic disparities in diet and obesity prevalence. The high-level trends in population-level characteristics in this study may inform more in-depth research examining these relationships using more granular operationalizations of socioeconomic status.

4.1. Policy implications

Across all countries, parents generally reported 'sometimes' or 'often' seeing marketing of unhealthy food and beverages while co-consuming video-based media with their children, despite regulatory or industry-led voluntary restrictions: this evidence provides further support to arguments that the current regulatory and voluntary approaches are ineffective at limiting children's exposure. The current findings reinforce the importance of comprehensive marketing restrictions that include digital media (World Health Organization, 2012), which uses meta-data to specifically target individuals based on their previous online activity and social media profiles (Tatlow-Golden et al., 2016). Given that the effectiveness of marketing is a function of exposure and persuasive power (World Health Organization, 2012), it is worth noting that while channels such as television and signage in stores may have extensive reach and frequency, others (like digital media) are designed to not only target, but engage, their audience with interactive and synergistic elements, including advergames, pop-up advertisements that link to further promotional content, and peer-to-peer advertising (Potvin Kent et al., 2019; Tatlow-Golden et al., 2016) and may have greater power in terms of their message design and content. In-depth

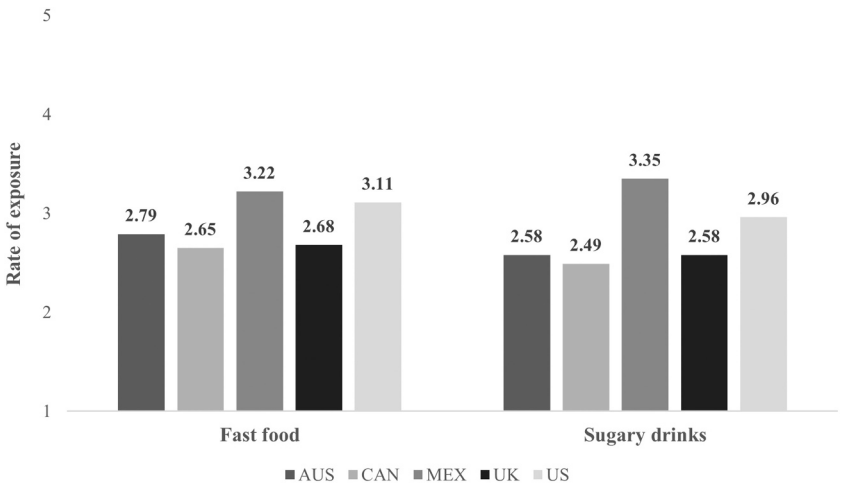

Fig. 2. Mean rate of exposure to marketing for fast food and sugary drinks among parents co-consuming media with children (Fast food: $N = 4279$; Sugary drinks: $N = 4228$)[a,b].
[a] excludes participants who reported that they hadn't viewed any media with their children.
[b] Mean response on a 5-point likert-type scale (1 = not at all, 2 = rarely, 3 = sometimes, 4 = often, 5 = all the time).
Abbreviations: AUS = Australia, CAN = Canada UK=United Kingdom, US = United States, MEX = Mexico.

analysis of the content and effectiveness of commercial food and beverage marketing is thus warranted.

4.2. Strengths and limitations

This study has several major strengths, including the use of the same measures across countries, large sample size, and novel measures of exposure to marketing. Self-reported methods of marketing exposure are still emerging in the literature as a method to assess exposure to food marketing (Kumar et al., 2015; Hammond and Reid, 2018; Forde et al., 2019), although they are commonly used in other domains (Southwell et al., 2002; Feighery et al., 2006; Davis et al., 2016; McAfee et al., 2017; Yong et al., 2008; Wadsworth et al., 2018). While self-reported exposure is likely only capturing a small portion of actual exposure to food marketing and is unable to capture unconscious, implicit or emotional effects of advertising (Boyland and Tatlow-Golden, 2017), empirical evidence has demonstrated that self-reported exposure is highly associated with objective exposure data. For example, evidence from tobacco marketing research reveals relatively high correlations between self-reported recall of media campaigns and objective exposure data, including audience viewership estimates (Southwell et al., 2002) and objective measurement of in-store marketing (Feighery et al., 2006). Self-reported exposure has also been shown to reflect different 'doses' of media: self-reported exposure to media campaigns is higher in markets where a given campaign aired more frequently (Davis et al., 2016; McAfee et al., 2017), and individuals living in jurisdictions with fewer restrictions report substantially greater exposure, and self-reported exposure decreases following restrictions in the same market (Yong et al., 2008; Wadsworth et al., 2018). Data from this study are limited in their ability to examine differences in the amount of exposure to food/drink marketing via particular marketing channels (television, digital, settings-based, etc.) (Kelly et al., 2019) or the amount of time spent on each type of media between countries (Global Web Index, 2017), which are known to differ between countries. These findings likely underestimate exposure to marketing of unhealthy foods, as self-reported measures may fail to capture all potential marketing exposures, and the operationalization of unhealthy foods and beverages was limited to that of fast food and sugary drinks, excluding other foods commonly marketed to children, such as candy or breakfast cereals (Kelly et al., 2013; Department of Health and Social Care: Global and Population Health Obesity Food and Nutrition Resource Centre, 2019).

This study is subject to limitations common to survey research. Participants were recruited using non-probability-based sampling; therefore, the findings do not provide representative estimates. For example, the weighted Mexico sample had higher levels of education than census estimates. Self-reported measures of marketing exposure are subject to bias, including recall bias which may differ across countries - and it is unclear how these may contribute to country-level differences in marketing exposure. Furthermore, respondents may have operationalized the concept of fast food and sugary drinks differently, despite the description provided in the survey question. Finally, the current findings did not assess exposure to food marketing among children directly; although parental exposure to food marketing may be a reasonable overall indicator or proxy and has been correlated with child intake in previous research (Barber et al., 2017; Duch et al., 2013; Davison and Francis LA Birch, 2005; Paudel et al., 2017), levels of exposure among children may differ, particularly with respect to specific marketing media channels. This may be increasingly relevant in contemporary media environments in which households have multiple devices (smartphones, tables, televisions) that can be used for viewing, and for older children who may have greater independence with regards to media spaces (e.g., social media) and access to devices (e.g., independent smartphone use). Future research should consider assessing similar measures among children, given that most regulations apply to programs and content that are targeted to or appeal to children. Future research may also want to consider examining online sources, social media and apps or among different streaming and social media platforms independently, as recent research suggests that these different environments may influence the impact of marketing messages.

5. Conclusion

The current study is the first to empirically examine international patterns in the self-reported exposure of parents to unhealthy food and beverage marketing across multiple media channels and when co-consuming video-based media with their children. Across countries, the number and types of marketing channels and settings through which parents were exposed to commercial food marketing, and the amount of marketing reported while parents and children were co-viewing video-based media was generally consistent; however, the results suggested greater exposure in the US and Mexico. Analyses revealed important differences by ethnicity, which may inform further in-depth research both between and within countries. These data may serve as a benchmark for monitoring and evaluation of forthcoming food and beverage marketing policies, such as those currently under consideration in Canada.

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Table 4
Estimates from separate linear regression models examining the rate of fast food and sugary drinks marketing exposure while co-viewing TV, videos and movies among parents and their children in five countries.

Parameter	Fast food marketing (N = 4265)		Sugary drinks marketing (N = 4216)	
	Wald χ^2	B (95% CI)	Wald χ^2	B (SE)
Intercept	1483.41*		1438.34	
Country	190.46*		466.21	
AUS vs. US		0.26 (0.16,0.36)*		0.29 (0.19,0.39)*
AUS vs. MEX		0.46 (0.37,0.56)*		0.83 (0.74,0.92)*
AUS vs. UK		−0.05 (−0.15,0.05)		0.09 (−0.009,0.18)
AUS vs. CA		−0.14 (−0.26,-0.02)*		−0.11 (−0.22,0.01)
CAN vs. US		0.40 (0.28,0.52)*		0.40 (0.28,0.52)*
CAN vs. MEX		0.61 (0.49,0.72)*		0.93 (0.82,1.05)*
CAN vs. UK		0.09 (−0.25,0.21)		0.19 (0.08,0.31)*
UK vs. US		0.31 (0.21,0.41)*		0.21 (0.11,0.31)*
UK vs. MEX		0.51 (0.42,0.60)*		0.74 (0.65,0.83)*
US vs. MEX		0.21 (0.11,0.30)*		0.53 (0.44,0.62)*
Age	5.38*	0.004 (0.001,0.008)*	3.89	0.003 (0.00002,0.007)
Sex	0.49		3.83	
Male vs. female		−0.02 (−0.09,0.04)		−0.06 (−0.12,0.0001)
Education	6.52*		5.99	
Low vs. medium		−0.02 (−0.11,0.08))		0.04 (−0.05,0.14)
Low vs. high		−0.09 (−0.18,−0.01)		−0.05 (−0.14,0.03)
High vs. medium		0.08 (−0.002,0.15)		0.09 (0.02,0.17)
Ethnicity	49.96*		75.29*	
Majority vs. minority		0.27 (0.19,0.34)*		0.33 (0.04) *
BMI	3.06		4.20	
Under/normal weight vs. overweight		0.03 (−0.05,0.10)		0.02 (−0.05,0.10)
Under/normal weight vs. Obesity		0.03 (−0.06,0.12)		0.03 (−0.06,0.11)
Under/normal weight vs. not reported		−0.06 (−0.16,0.04)		−0.08 (−0.18,0.02)
Overweight vs. Obesity		0.002 (−0.09,0.09)		0.00 (−0.09,0.09)
Overweight vs. not reported		−0.09 (−0.19,0.02)		−0.10 (−0.21,0.002)
Obesity vs. not reported		−0.09 (−0.20,0.02)		−0.10 (−0.22,0.008)

Abbreviations: CAN=Canada, AUS = Australia, UK=United Kingdom, US=-United States, MEX = Mexico; B=Beta; SE = Standard error.
Notes: The variable listed first is the reference variable.
* Indicates that confidence intervals remain significant after adjustment for Benjamini-Hochberg procedure using a conservative false discovery rate of 0.05.

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Declaration of Competing Interest

In 2018, Elise Pauzé received a small honorarium from the Stop Marketing to Kids Coalition, an allied group of non-profit health organizations, for providing expert advice. David Hammond has served as a paid expert witness on behalf of public health authorities in response to litigation from the food and beverage industry.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2021.106521.

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