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# BMJ Open

## Children's and adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

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3 **Children's and adolescents' media usage and self-reported exposure to advertising**  
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5 **across six countries: implications for less healthy food and beverage marketing**  
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43 **Abbreviations**

44  
45 IFPS : International Food Policy Study

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48 UK : United Kingdom

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50 USA : United States of America  
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55 **Word count : 5780**  
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3 1 **ABSTRACT**

4  
5 2 **Objectives:** The study objectives were to examine: 1) children's and adolescent's media  
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8 3 viewing habits; 2) associations with media viewing and self-reported exposure to  
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10 4 unhealthy food and beverage advertising; and 3) differences in trends among population  
11  
12 5 subgroups (particularly between children and adolescents) in six high and upper-middle  
13  
14  
15 6 income countries.

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17 7 **Design:** Repeat cross-sectional online survey.

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19 8 **Setting:** Australia, Canada, Chile, Mexico, the United Kingdom (UK) and the United  
20  
21 9 States (USA).

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24 10 **Participants:** Respondents to the International Food Policy Study (IFPS) who provided  
25  
26 11 information on all variables of interest in November-December 2019 aged 10 to 17 years  
27  
28 12 (n=9171).

29  
30  
31 13 **Outcome measures:** Self-reported exposure to screen-based media (screen time by  
32  
33 14 media channel), use of social media platforms, and location and frequency of exposure to  
34  
35 15 unhealthy food and beverage advertising.

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37  
38 16 **Results:** The average amount of time spent in front of various screens ranged from 7.6  
39  
40 17 hours to 10.2 hours across countries per weekday. Overall, Instagram was the most  
41  
42 18 popular social media platform (52-68% by country), followed by Facebook (42-79%) and  
43  
44 19 Snapchat (28-52%). The percentage of respondents who reported having seen unhealthy  
45  
46 20 food advertisements in the past 30 days was highest on television (43-69%), followed by  
47  
48 21 digital media (27-60%) and gaming applications (10-17%). Self-reported exposure to  
49  
50 22 advertising varied between countries for sugary drinks (10-43%) and fast food (19-44%),  
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52 23 and was positively associated with screen time. Exposure to screen-based media and  
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24 social media platforms differed by socio-demographic characteristics, and was higher  
25 among adolescents than children.

26 **Conclusions:** The large percentages of children across all countries who report viewing  
27 screen-based media and high rates of advertising exposure, support the need for policies  
28 to restrict marketing of unhealthy food and beverages targeted at children and adolescents  
29 on screen-based media.

30  
31 **Keywords:** Food marketing; food policy; marketing to children; broadcast media; digital  
32 media; children; adolescents; food environment

### 34 **Article summary**

#### 35 **Strengths and limitations of this study**

- 36 • The study has a large sample size, and employs the same measures across  
37 countries, allowing justifiable comparisons between countries.
- 38 • Assessed exposure to a wide range of social media platforms, and differentiated  
39 locations of exposure to screen-based marketing.
- 40 • Children and adolescents retrospectively self-reported the estimated screen time  
41 spent on each media channel rather than using a more objective approach.
- 42 • Self-reported exposure to marketing may result in an underestimation of exposure  
43 to marketing, and this study provides a conservative estimate.
- 44 • Time spent watching cable television vs. on streaming applications (Netflix,  
45 Crave, Amazon Prime Video, etc.) was not distinguished in this study.

## 1. Introduction

In recent decades, children and adolescents have become the targets of a variety of marketing techniques, many of which exploit their vulnerabilities. Children are most often not able to recognize the persuasive intent of marketing and may perceive it as entertainment, making them particularly susceptible to marketing content (1). Children and adolescents are a potentially important market segment, as effective marketing towards them can build early positive associations, create life-long consumers and brand relationships that extend into adulthood (2, 3). As such, the WHO and others have called for restrictions on marketing to children of specific products (such as tobacco or vaping products and unhealthy foods or beverages). Some jurisdictions, such as the province of Quebec (Canada), the UK, Chile and Mexico have implemented policies restricting unhealthy food marketing targeted at children typically 13 years and under (4), as it is well established that food marketing influences children's dietary preferences for products, consumption patterns, and shapes their purchasing behavior as well as their purchase requests to parents (5-8).

Effective food marketing depends on both exposure (defined as the number of people seeing the message and the frequency to which the person is exposed to the message) and power (defined as the "creative content, design and execution of the marketing message"), which both vary considerably between media channels or types (9, 10). Various marketing techniques are used across media channels to optimize the effectiveness of marketing, and may differ both in their impact on children as well as whether or not children can recognize them as advertising (7, 11-14). Screen-based media, which for the large part includes television, digital media (including social media)

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3 71 and gaming sites, all have different implications with regard to the exposure and power of  
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5 72 marketing messages that reach their audience.  
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8 73 Companies are increasingly using digital platforms as a complement to traditional  
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10 74 advertising on television in a mixed-media approach to maximize the reach, efficiency  
11  
12 75 and effectiveness of marketing (15, 16). Globally, time spent online on social media,  
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14 76 gaming, streaming, and browsing the web is significant, and appears to be increasing in  
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16 77 some countries (17-19), representing an important channel for advertising energy dense  
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18 78 products (20-24). Given the shifting media consumption habits of children and  
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20 79 adolescents, exploration of media consumption and associations with exposure to  
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22 80 marketing of less healthy food products, and their patterning by demographic and socio-  
23  
24 81 economic factors is warranted. Most studies to date that examine media consumption  
25  
26 82 habits among children have been limited to a single media type, and do not examine  
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28 83 exposure across multiple countries. This study aimed to explore children's and  
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30 84 adolescent's media consumption habits (screen time and use of social media platforms)  
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32 85 and associations with self-reported exposure to unhealthy food and beverage  
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34 86 advertisements (location and frequency) across six high and upper-middle income  
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36 87 countries (Australia, Canada, Chile, Mexico, UK and USA). As a secondary objective,  
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38 88 the study aimed to examine differences in trends among population subgroups, and in  
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40 89 particular differences in trends between children (10-13 years) and adolescents (14-17  
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42 90 years), the latter of which often fall outside the purview of policies restricting marketing  
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44 91 of unhealthy food and beverages.  
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51 92 **2. Subjects and methods**  
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3 93 Data are from the 2019 International Food Policy Study (IFPS) Youth Survey, an  
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5 94 annual repeat cross-sectional survey conducted in Australia, Canada, Chile, Mexico, the  
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8 95 UK and the USA. Data were collected via self-completed, web-based surveys conducted  
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10 96 in November-December 2019 with children and adolescents aged 10 to 17 years.  
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12 97 Respondents were recruited through parents/guardians enrolled in the Nielsen Consumer  
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14 98 Insights Global Panel and their partners' panels. Email invitations with unique survey  
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16 99 links were sent to adult panelists within each country. Those who confirmed they had a  
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18 100 child aged 10 to 17 living in their household were asked for permission for their child to  
19  
20 101 complete the survey (only one child per household was invited). Children aged 10 to 17  
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22 102 years were eligible to participate, with quotas for age and sex groups in the UK and USA.  
23  
24 103 After eligibility screening, all potential respondents were provided with information  
25  
26 104 about the study and asked to provide assent. Surveys were conducted in English in  
27  
28 105 Australia and the UK; Spanish in Chile and Mexico; English or French in Canada; and  
29  
30 106 English or Spanish in the USA. Members of the research team who were native in each  
31  
32 107 language reviewed the French and Spanish translations independently. The median  
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34 108 survey time was 24 minutes.

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39 109 The child's parent/guardian received remuneration in accordance with their panel's  
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41 110 usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes).  
42  
43 111 A full description of the study methods can be found in the International Food Policy  
44  
45 112 Study: Technical Report – 2019 Youth Survey at  
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47 113 [http://foodpolicystudy.com/methods/\(25\)](http://foodpolicystudy.com/methods/(25)).  
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## 50 114 **2.1 Total screen time and screen time by media channel and activity**

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3 115 Self-reported daily screen time was measured using the question: “*On a normal*  
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5 116 *weekday, how much time do you spend...?*” Participants were asked to answer this  
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8 117 question for five different media channels and/or activities: YouTube, social media  
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10 118 (including messaging, posting, or liking posts); TV (shows, series, or movies); playing  
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12 119 games (on smartphones, computers, or game consoles); and browsing (reading websites,  
13  
14 120 Googling, etc.). Responses for amount of screen time for each media channel were  
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16 121 captured using a scale (none; up to 15 minutes; up to 30 minutes; up to 1 hour; up to 2  
17  
18 122 hours; up to 3 hours; up to 4 hours; more than 4 hours; don’t know; refuse to answer).  
19  
20 123 The same question was presented afterwards for a “normal weekend day”. Although the  
21  
22 124 phrasing “up to” means that participants could have watched less than the stated value,  
23  
24 125 the ceiling value was used to calculate an estimated amount of time in minutes spent on  
25  
26 126 each media channel and all channels combined. For example, up to 15 minutes was  
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28 127 recoded as 15 minutes, and up to 1 hour was recoded as 60 minutes. Those who  
29  
30 128 responded “more than 4 hours” were recoded as 300 minutes (i.e., 5 hours). As children  
31  
32 129 could have been viewing multiple media channels simultaneously, the sum of exposure  
33  
34 130 (i.e., total minutes across all media types) was used as an overall indicator of total amount  
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36 131 of exposure to screen-based media. Winsorization was used to limit the effect of extreme  
37  
38 132 values on total screen time (26). The maximum amount of total screen time was set at the  
39  
40 133 mean + 2 SD, in this case 1195 minutes for a weekday and 1268 minutes for a weekend  
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42 134 day. Participants (n=572, weekday (6.2%) and n=432, weekend day (4.7%)) who  
43  
44 135 exceeded this value had their total screen time decreased to the maximum. The  
45  
46 136 winsorization technique yielded a slightly higher cutoff (+73 minutes) for weekends, as  
47  
48 137 might be expected. The maximum amount obtained using this method was compared  
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3 138 with a hypothetical estimation based on an assumption that on a weekday, children and  
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5 139 adolescents spend roughly 7 hours at school and 8 hours sleeping, which sums up to 15  
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7 140 hours. It is plausible that there may have been some screen time during school hours that  
8  
9 141 would fall within the aforementioned categories (browsing or watching YouTube), and so  
10  
11 142 it was assumed that this was approximately 1 hour. The total (14 hours) was subtracted  
12  
13 143 from the length of a day (24 hours) to give a possible maximum of 10 hours of screen  
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15 144 time, with a maximum of 20 hours if two screens were being used simultaneously. This  
16  
17 145 estimation of 20 hours (1200 minutes) confirms the measure of total maximal screen time  
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19 146 for weekdays (1195 minutes) and weekends (1268 minutes) has good face-validity.  
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## 24 147 **2.2 Usage of social media platforms**

25  
26 148 Self-reported usage of various social media platforms was assessed using the  
27  
28 149 measure: “*Do you use...? (select all that apply)*” (Response options: “Facebook”,  
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30 150 “Instagram”, “TikTok”, “Twitter”, “Snapchat”, “none of the above”, “don’t know” or  
31  
32 151 “refuse to answer”).  
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## 35 152 **2.3 Location of exposure to unhealthy food and beverage advertisements**

36  
37 153 The location of exposure to advertisements was assessed using the question: “*Have*  
38  
39 154 *you seen or heard advertisements for “unhealthy” foods or drinks in any of these places*  
40  
41 155 *in the last 30 days?*” Participants were instructed “*Unhealthy food and drinks include*  
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43 156 *processed foods high in sugar, salt, or saturated fat, such as soda/pop, fast food, chips,*  
44  
45 157 *sugary cereals, cookies and chocolate bars.*” Participants could select all the responses  
46  
47 158 that applied from a list of 13 potential media channels, and an ‘other’ option with an  
48  
49 159 open-text box, or “I haven’t seen any ads for unhealthy food in the last 30 days”, “don’t  
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51 160 know” or “refuse to answer.” In this study, three channels were analyzed that pertain to  
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3 161 screen-based media (television shows, series or movies; website or social media; and  
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5 162 video or computer games). Open text data were reviewed, and responses were re-coded to  
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7 163 be included as one of the categorical options as applicable. “YouTube” and “social  
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9 164 media” were recoded to be included in the category “website or social media” and “TV”  
10  
11 165 was re-coded in the category of television shows. When participants wrote “all” in the  
12  
13 166 open text, these responses were coded in each category of marketing location.  
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#### 17 167 **2.4 Frequency of exposure to unhealthy food and beverage marketing**

18  
19 168 The frequency of exposure to unhealthy food and beverage marketing was assessed  
20  
21 169 using the question: “*In the last 30 days, how often did you see or hear advertisements for*  
22  
23 170 *these kinds of food or drinks?*” Participants responded for advertisements for six food  
24  
25 171 categories, two of which were included in this analysis (sugary drinks; fast food from a  
26  
27 172 restaurant). The frequency was assessed using a likert-type scale. (Response options:  
28  
29 173 “never”, “less than once a week”, “once a week”, “a few times a week”, “everyday”,  
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31 174 “more than once a day”, “don’t know” and “refuse to answer”). Frequency of exposure  
32  
33 175 was then recoded as a binary variable, where “everyday” and “more than once a day”  
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35 176 were combined as “daily”, and the other options combined as “less than once a day”;  
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37 177 responses of “don’t know” or “refused” were considered as missing.  
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#### 42 178 **2.5 Socio-demographic measures**

43  
44 179 Socio-demographic data included age, ethnicity, sex, country, school grades and  
45  
46 180 perceived income adequacy. Age was included as a binary variable, (children aged 10 to  
47  
48 181 13 years, and adolescents aged 14 to 17 years). Ethnicity was assessed using unique  
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50 182 measures from each country and re-coded to derive comparable measures across  
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52 183 countries: *majority* or *minority* ethnicity. Participant’s sex was self-reported by asking  
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3 184 “*Are you...*” with responses “male” or “female”. School grades were measured using the  
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5 185 question: “*What grades do you usually get in school?*” Response options varied across  
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7 186 countries and were re-coded to derive comparable measures across countries and three  
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9 187 groups were created: “low” (<grade of B in most countries), “mid” (grade of B in most  
10  
11 188 countries) or “high” grades (grade of A in most countries). Perceived income adequacy  
12  
13 189 was examined using the measure: “*Does your family have enough money to pay for*  
14  
15 190 *things your family needs?*” (Response options: “not enough money”, “barely enough  
16  
17 191 money”, “enough money”, “more than enough money”, “don’t know” and “refuse to  
18  
19 192 answer”). Perceived income adequacy was recoded as a binary variable, (not enough  
20  
21 193 money/barely enough money were combined as “inadequate” and enough money/more  
22  
23 194 than enough money were combined as “adequate”); responses of “don’t know” or  
24  
25 195 “refused” were considered as missing and excluded from analyses. Participant’s body  
26  
27 196 mass index (BMI) was calculated using self-reported height and weight. BMI was  
28  
29 197 assessed using z-scores and classified according to the WHO recommendations (27).  
30  
31 198 *Severe thinness, thinness* and *normal weight* were combined considering low levels of  
32  
33 199 respondents for the *severe thinness and thinness* category (All countries = 2.9%,  
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35 200 Australia = 3.3%, Canada = 4.2%, Chile = 0.9%, Mexico = 1.7%, UK = 2.8%, US =  
36  
37 201 3.0%). Extreme values were recoded as missing (z-score < -5 or > 5) according to the  
38  
39 202 WHO growth reference guidelines (28). Extreme values as well as those participants  
40  
41 203 whose height and/or weight were missing were coded as “not reported” and included in  
42  
43 204 the analytic sample to reduce bias as potentially important differences between those who  
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45 205 do not report their height and weight in population-level surveys have been identified  
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3 206 (29). A full list of measures in each country is available at  
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5 207 <http://foodpolicystudy.com/methods/> in the surveys section (30).  
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## 8 208 **2.6 Data analysis**

9  
10 209 A total of 11,491 children and adolescents completed the survey. Respondents were  
11  
12 210 excluded for the following reasons: region was missing, ineligible or had an inadequate  
13  
14 211 sample size (i.e., Canadian territories); invalid response to a data quality question; and/or  
15  
16 212 survey completion time under 10 minutes (n=383). The analytic sample included 11,108  
17  
18 213 respondents (Australia: n=1,435; Canada: n=3,682; Chile: n=1,252; Mexico: n=1,616;  
19  
20 214 UK: n=1,520; USA: n=1,603). A sub-sample (N=9,171) was included in the current  
21  
22 215 analysis after excluding respondents with missing data (including don't know and refuse  
23  
24 216 to answer) for social media usage, screen time, location and frequency of exposure to  
25  
26 217 unhealthy food and beverage marketing, ethnicity, school grades and perceived income  
27  
28 218 adequacy (**Supplementary Figure S1**). Data were weighted with post-stratification  
29  
30 219 sample weights constructed using a raking algorithm with population estimates from the  
31  
32 220 census in each country based on age group, sex, region, and ethnicity (except in Canada).  
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34 221 Reported estimates are weighted.  
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40 222 Descriptive statistics were tabulated including the mean number of hours viewing  
41  
42 223 screen-based media across all channels and by channel on a weekday and weekend day,  
43  
44 224 the usage of each social media platform and mean number of social media platforms  
45  
46 225 (maximum of 5 platforms), the frequency of the three advertisement locations and the  
47  
48 226 percentage of respondents being exposed daily to advertisements for sugary drinks and  
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50 227 fast food by country.  
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3 228 Regression models examined differences in the amount of exposure to screen-based  
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5 229 media between countries and population subgroups. First, linear regressions were  
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7 230 conducted with the amount of exposure to screen-based media (total screen time in  
8  
9 231 minutes) as the dependent variable, including an indicator variable for country and  
10  
11 232 variables for sex, age category (10-13 years, 14-17 years), ethnicity, perceived income  
12  
13 233 adequacy, school grades, and BMI. Next, separate logistic regression models were  
14  
15 234 conducted for each social media type (1=yes, 0=no), including an indicator variable for  
16  
17 235 country and including the same list of correlates. Lastly, separate logistic regression  
18  
19 236 analyses were used to examine associations between the exposure to screen-based media  
20  
21 237 and daily frequency of self-reported exposure to advertisements for each of the food  
22  
23 238 categories (sugary drinks; fast food from a restaurant), with daily exposure to sugary  
24  
25 239 drink or fast food marketing as the dependent variable, including indicator variables for  
26  
27 240 the amount of exposure on a weekday (continuous) and country, adjusting for the same  
28  
29 241 demographic correlates. Separate models were tested for exposure to screen-based media  
30  
31 242 on weekends. For all regressions, survey-aware procedures were used to account for  
32  
33 243 finite sampling methods, and 99% confidence intervals are presented due to the use of  
34  
35 244 multiple comparisons. Analyses were conducted using SAS v. 14.

### 36 245 **2.7 Patient and public involvement**

37 246 Patients and the public were not involved in the design, conduct, analysis or  
38  
39 247 interpretation of the study. Study participants could have access to the study results upon  
40  
41 248 request.

### 42 249 **3. Results**

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2  
3 250 Weighted sample characteristics are presented in **Table 1**. There were differences  
4  
5 251 between countries in ethnicity group, school grades, perceived income adequacy and  
6  
7 252 BMI. In general, a greater percentage of participants identified as a minority group in the  
8  
9 253 USA, a smaller percentage had high school grades in Australia and the UK, and a greater  
10  
11 254 percentage perceived their family income as adequate in Canada.  
12  
13

### 14 255 **3.1 Exposure to screen-based media**

15  
16  
17 256 **Figure 1** shows the mean amount of total screen time for a weekday among  
18  
19 257 participants across countries, which ranged from 7.6 hours (Canada and Australia) to 10.2  
20  
21 258 hours (Chile). Similar findings were observed across countries for a weekend day, but  
22  
23 259 with higher total amounts (**Supplementary Figure S2**), which ranged from 8.9 hours  
24  
25 260 (Canada) to 11.2 hours (Chile). Time spent on various media channels is shown in  
26  
27 261 **Supplementary Figure S3**. Digital media, comprised of YouTube, social media and  
28  
29 262 browsing, reading websites and Googling, was the largest contributor overall, and  
30  
31 263 comprised 4.8 hours (weekday) and 5.4 hours (weekend day) on average. Browsing,  
32  
33 264 reading websites and Googling accounted for the least amount of screen time on a  
34  
35 265 weekday and weekend day in all countries. Across all countries, participants in Chile  
36  
37 266 spent the highest amount of time on YouTube, social media, playing games and  
38  
39 267 browsing, while participants in the USA spent the most time watching television on a  
40  
41 268 weekday.  
42  
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46  
47 269 Estimates from a linear regression model examining the total amount of exposure to  
48  
49 270 screen-based media on a weekday across countries is shown in **Table 2**. Total screen time  
50  
51 271 differed by country, and across all demographic correlates. Participants in Canada and  
52  
53 272 Australia reported less screen time than those in Chile, Mexico and USA; and Chilean  
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3 273 participants reported more screen time than those in all other countries except Mexico.  
4  
5 274 Female participants self-reported less screen time than their male counterparts;  
6  
7 275 adolescents spent more time on screens than children; participants from minority  
8  
9 276 ethnicity groups and those who perceived their family income as inadequate had a greater  
10  
11 277 self-reported exposure to screen-based media. Those who described themselves as having  
12  
13 278 high grades in school (compared to low and moderate) spent less time on screens.  
14  
15 279 Participants classified as having obesity had a greater total screen time than those of all  
16  
17 280 other BMI categories and those who did not report their height and weight. Those who  
18  
19 281 did not report their BMI (height and/or weight) had less screen time (compared to  
20  
21 282 overweight) and those in the overweight category had greater screen time compared to  
22  
23 283 participants in the severe thinness/thinness/normal weight category. The same pattern of  
24  
25 284 results was observed for a weekend day, except for the findings on BMI, for which there  
26  
27 285 were only associations between those with obesity vs. all other categories  
28  
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31  
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33 286 **(Supplementary Table 1).**

### 35 287 **3.2 Social media exposure**

36  
37 288 The percentage of participants using different social media platforms across countries  
38  
39 289 is shown in **Figure 2**. Overall, 77% to 87% of children were using at least one of the  
40  
41 290 social media platforms, which varied by country. On average, the most commonly used  
42  
43 291 platform was Instagram (range: from 52% in Australia and the USA to 68% in Chile),  
44  
45 292 followed by Facebook (range: from 42% in Canada to 79% in Mexico), and Snapchat  
46  
47 293 (range: from 28% in Chile to 52% in the UK). TikTok usage ranged from 20% (Mexico)  
48  
49 294 to 32% (Canada) and Twitter usage ranged from 16% (Australia) to 34% (Mexico).  
50  
51  
52  
53 295 Participants who reported no social media application use ranged from 13% (Mexico) to  
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3 296 23% (Australia). The mean number of social media platforms used per respondent across  
4  
5 297 countries is shown in **Supplementary Figure S4**, and ranged from 1.9 platforms  
6  
7  
8 298 (Australia and Chile) to 2.2 platforms (Mexico).  
9

10 299 Estimates from separate logistic regression models examining exposure to social  
11  
12 300 media platforms across countries are shown in **Table 3**. Exposure to social media  
13  
14 301 platforms differed by country and age group for all platforms, and significant differences  
15  
16 302 by sex, perceived income adequacy, school grades and BMI for some platforms.  
17  
18 303 Specifically, participants in Canada were less likely to use Facebook than those in all  
19  
20 304 other countries, whereas participants in Mexico were more likely to use Facebook than  
21  
22 305 those in all other countries. Those in Chile were more likely to use Instagram than those  
23  
24 306 in all other countries. Participants from Canada were more likely to use TikTok than  
25  
26 307 participants in Australia, Chile, Mexico, the UK. Participants in Mexico were more likely  
27  
28 308 to use Twitter than participants in all other countries, and those in the UK were more  
29  
30 309 likely to use Snapchat than those in all other countries except the USA. Participants in  
31  
32 310 Australia were more likely to not use a social media platform compared to all other  
33  
34 311 countries except the USA. Female participants were more likely to use Instagram, TikTok  
35  
36 312 and Snapchat; adolescents (ages 14-17) were more likely to use all social media platforms  
37  
38 313 except TikTok (compared to children ages 10-13); and ethnicity groups were not  
39  
40 314 associated with exposure to social media platforms. Participants who perceived their  
41  
42 315 family income as adequate were more likely to use Twitter; and participants who reported  
43  
44 316 having high grades in school (compared to low and moderate) were less likely to use  
45  
46 317 Facebook and TikTok. Those who were classified as having obesity were more likely to  
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3 318 use all social media platforms except Twitter compared to those whose BMI was is the  
4  
5 319 category “not reported”.

7  
8 320 **3.3 Location of screen-based exposure to advertisements for unhealthy foods or**  
9  
10 321 **drinks**

11  
12 322 The percentage of children and adolescents who reported that they were exposed to  
13  
14 323 advertisements for unhealthy foods or drinks in three locations in the previous 30 days is  
15  
16 324 shown in **Figure 3**. Overall, TV shows, series or movies accounted for the largest number  
17  
18 325 of participants self-reporting exposure to advertisements (range: from 43% in the UK to  
19  
20 326 69% in Mexico and Chile), followed by websites or social media (range: from 27% in the  
21  
22 327 UK to 60% in Chile), and video or computer games (range: from 10% in Australia and  
23  
24 328 the UK to 17% in Chile).

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28 329 **3.4 Daily exposure to sugary beverage and fast food advertisements**

29  
30 330 The percentage of respondents who reported that they were exposed daily to  
31  
32 331 advertisements for both food categories in the last 30 days is shown in **Figure 4**. Self-  
33  
34 332 reported daily exposure to sugary drinks advertisements ranged from 10% (UK) to 43%  
35  
36 333 (Mexico). Self-reported daily exposure to fast food advertisements was relatively more  
37  
38 334 consistent across countries, with the exception of the UK (range: from 19% in the UK to  
39  
40 335 44% in the USA).

41  
42 336 Estimates from separate logistic regression models examining daily exposure to  
43  
44 337 sugary beverage and fast food advertisements across countries are shown in **Table 4**.  
45  
46 338 Participants who self-reported more time spent on screen-based media were more likely  
47  
48 339 to report daily exposure to advertisements for both food categories. Daily exposure to  
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50 340 advertisements for sugary drinks and fast food differed by country, BMI and amount of  
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3 341 exposure to screen-based media (total screen time in minutes), and patterns were mostly  
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5 342 similar across both food categories; there was no significant difference in exposure by  
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8 343 age group. Overall, participants in Mexico and Chile were much more likely to report  
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10 344 daily exposure to sugary beverage advertisements than participants in all other countries,  
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12 345 with fewer differences for fast food advertisements. Participants in the UK were less  
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14 346 likely to report daily exposure to advertisements of sugary drinks and fast food compared  
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16  
17 347 to all other countries and those in the USA were more likely to report daily exposure to  
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19 348 fast food advertisements than those in all other countries. Participants who did not report  
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21 349 their height or weight were less likely to report daily exposure to advertisements for both  
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23  
24 350 types of food categories compared to participants living with obesity, overweight or in  
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26 351 the severe thinness/thinness/normal weight category. There were no other significant  
27  
28 352 differences by socio-demographic characteristics. The same pattern of results was  
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30  
31 353 observed for exposure to screen based media on a weekend day (**Supplementary Table**  
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33 354 **S2**).

#### 355 **4. Discussion**

##### 356 **Summary of main findings**

357 This study found that children and adolescents across Australia, Canada, Chile,  
358 Mexico, UK and USA are spending considerable amounts of time viewing screen-based  
359 media. On average, children and youth reported between 7.5 hours and 10.2 hours of  
360 screen time, which varied by country. Digital media accounted for the most time on  
361 screens and social media use varied by platforms. Across all countries, self-reported  
362 exposure to advertisements in the past 30 days was reported most frequently on  
363 television, followed by digital media and gaming platforms. Between-country differences

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3 364 were identified: participants in the UK reported less daily exposure to fast food and  
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5 365 sugary drinks advertisements, whereas participants in the USA reported greater daily  
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7 366 exposure to fast food advertisements. Most importantly, our results show that in all  
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9  
10 367 countries, self-reported exposure to advertisements increased with greater screen time.  
11  
12 368 Analyses suggested important differences in exposure to screen-based media and social  
13  
14 369 media platforms between age groups, with adolescents reporting an overall greater  
15  
16 370 exposure to food advertisements.

### 19 371 **Relationships with existing knowledge**

21 372 The estimates from this study are similar to other international estimates of self-  
22  
23 373 reported screen time. In the US, screen time among children 8-12 years in 2019 was  
24  
25 374 estimated to be 4 hours 45 mins, and 7 hours and 22 minutes among 13-18 year olds,(31)  
26  
27 375 compared to just over 9 hours in the current study among the older age group. A large  
28  
29 376 national Canadian study from 2013-2014 suggest that youth ages 12 to 17 spent on  
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31 377 average between 7.5 and 8 hours in front of screens daily,(32) very similar to the current  
32  
33 378 findings of approximately 7.75 hours. In the current study, most children and adolescents  
34  
35 379 are exceeding screen time guidelines across countries, which recommend entertainment  
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37 380 screen time be limited to less than 2 hours daily for school-aged children and adolescents  
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39 381 (33-35). Screen time has previously been associated with youth obesity (36, 37), poorer  
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41 382 diet quality (38), and consumption of less healthy foods and beverages (39, 40). The  
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43 383 general level of exposure reported among the sample, while an approximation, is cause  
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45 384 for concern.

51 385 The large proportion of children and adolescents using social media platforms has  
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53 386 important implications for food and beverage marketing. Companies are increasingly  
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3 387 developing strategies to engage with their audience through these media platforms, which  
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5 388 have a high likelihood of reaching children and adolescents even when they are not the  
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7 389 primary target audience. Research from Canada has estimated that children were exposed  
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9 to food and beverage marketing (of which the great majority is “less healthy”) on social  
10  
11 390 media apps 30 times per week while adolescents were exposed on average 189 times per  
12  
13 391 week (22). In our study, children and adolescents generally reported using two social  
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15 392 media platforms on average, therefore exposing them to various types and amounts of  
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17 393 marketing strategies across platforms. For instance, Instagram—the most commonly  
18  
19 394 reported social media platform among participants—is known to promote poor nutritional  
20  
21 395 quality foods and beverages are commonly promoted through popular brand accounts  
22  
23 396 using a range of marketing strategies that appeal to children and adolescents, such as  
24  
25 397 competitions and the use of characters that appeal to children (41). Unhealthy food  
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27 398 brands on Facebook are known to use techniques such as competitions based on user-  
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29 399 generated content, interactive games, and apps.(42) These results suggest a high level of  
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31 400 exposure via social media.  
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37 402 In this study, a greater proportion of children and adolescents reported exposure to  
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39 403 advertisements for unhealthy foods or drinks on television compared to websites, social  
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41 404 media applications or gaming sites. Greater reporting may be in part due to the different  
42  
43 405 types of advertising between these channels. In order for children to be aware of  
44  
45 406 advertisements, they need to be able to identify the difference between an advertisement  
46  
47 407 and other content, but also understand the persuasive intent behind the message (43).  
48  
49 408 Self-reported exposure to advertisements on television may have been higher as it is more  
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51 409 easily identifiable compared to digital marketing which often uses subtle marketing  
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3 410 techniques (e.g. such as celebrity endorsements by influencers and native advertising  
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5 411 designed to imitate editorial content) and is frequently disguised as entertainment (43,  
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7 412 44). On digital media, children and adolescents may simply be less able to discriminate  
8  
9 413 advertisements from other content, making marketing on these channels particularly  
10  
11 414 alarming. Digital marketing via advertisements is typically targeted, using cookies and  
12  
13 415 other means which record personal preferences, online activity, and location and these  
14  
15 416 data are then used to personalize and target the content of marketing to individual users,  
16  
17 417 therefore increasing the persuasive power of marketing (9, 11). The subtle advertising  
18  
19 418 techniques used on digital media, such as influencer endorsements or advergames may be  
20  
21 419 more likely to bypass children's cognitive awareness. However, our data align with  
22  
23 420 marketing expenditure data, an objective indicator of marketing efforts by companies:  
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25 421 fast-food advertisement expenditures are the highest for television, although digital  
26  
27 422 marketing expenditures increased by 74% between 2012 and 2019 (45).

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29 423 Self-reported daily exposure to advertisements was high for both fast food and sugary  
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31 424 drinks, with 34% and 25% of the sample reporting daily exposure, respectively, in all  
32  
33 425 countries. Perhaps unsurprisingly, those reporting more screen time were more likely to  
34  
35 426 be exposed daily to sugary drink and fast food advertisements. Differences across  
36  
37 427 countries may in part relate to differences in restrictions on marketing directed at  
38  
39 428 children. In the UK, where participants were less likely to be exposed daily to  
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41 429 advertisements for fast food and sugary drinks than those in all other countries, a total  
42  
43 430 ban of advertisements for unhealthy foods and beverages has been in place since 2007  
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45 431 during and adjacent to television programs appealing to children and adolescents under  
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47 432 the age of 16 (46). While evidence on the impact of the UK policy is mixed, findings  
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3 433 suggests that despite some changes in children's exposure, advertisements typically  
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5 434 shifted to other media channels, implying important loopholes in regulations (47, 48). In  
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8 435 the USA, where participants were more likely to report daily exposure to fast food  
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10 436 advertisements than those in all other countries, voluntary self-regulatory approaches to  
11  
12 437 restrict marketing by the industry are the only form of marketing restrictions, which  
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14  
15 438 target children under 12 years of age on media where the audience is mostly children  
16  
17 439 (49), and have largely proven ineffective at decreasing children's exposure to marketing  
18  
19 440 for unhealthy products (45, 50, 51). It is important to note that the present study cannot  
20  
21 441 capture the effectiveness of restrictive marketing policies by its cross-sectional design,  
22  
23  
24 442 but studying trends in both screen-time and social media use and self-reported exposure  
25  
26 443 annually over time using the IFPS should help evaluate the impact of impending policies,  
27  
28 444 such as the recently announced policy in the UK which will ban online advertising by the  
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31 445 end of 2022 and ban advertising of foods high in fat, sugar and salt between 5:30 am and  
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33 446 9 pm (52-54).

34  
35 447 Age group was an important predictor for screen-based media and social media  
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37 448 exposure, with adolescents spending more time on screens and using social media  
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39 449 platforms more than children. Adolescents may be an age group of particular interest to  
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42 450 marketers because of their greater spending power compared to children, which also  
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45 451 increases with age, therefore having the potential to create life-long brand relationships  
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47 452 and product consumers (55, 56). Marketers target adolescents through digital media by  
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49 453 using "ubiquitous connectivity, personalization, peer-to-peer networking, engagement,  
50  
51 454 immersion and content creation", which are features especially appealing to this age  
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54 455 group (56). In our study, there were no differences in daily self-reported exposure to  
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3 456 sugary drink and fast food advertisements between children and adolescents. Despite  
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5 457 adolescents having an improved ability to recognize advertisement content and the  
6  
7 458 persuasive intent of marketing compared to their younger counterparts, adolescents may  
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9  
10 459 be even more vulnerable to digital food marketing, because of their increased use of these  
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12 460 platforms as well as desire to conform with social norms in their peer group (57, 58).  
13  
14 461 Greater exposure to digital and social media platforms may also increase the number of  
15  
16 462 subtle marketing strategies, for example viral marketing (peer-to-peer), contests, quizzes  
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18 463 and marketing by influencers, which may not be captured in self-report measures if the  
19  
20 464 participant is unable to identify these as marketing strategies.  
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#### 24 465 **4.1 Strengths and limitations**

26 466 This study has a large sample size, and the same measures were used across countries,  
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28 467 allowing justifiable comparisons between countries. Many studies use expenditures or  
29  
30 468 gross ratings points, which provide objective data, but do not indicate who is exposed at  
31  
32 469 the individual level, including individual-level correlates. Furthermore, these traditional  
33  
34 470 approaches are less effective for digital media. More intensive approaches—such as  
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36 471 devices that directly monitor websites or device usage—provide precise measures of  
37  
38 472 exposure but are typically less feasible at a population level. One of the major strengths  
39  
40 473 of this study is the wide range of social media platforms, and the differentiated locations  
41  
42 474 of exposure to screen-based marketing assessed. Self-reported exposure to food  
43  
44 475 marketing is a method used by researchers in large population samples (57, 59, 60) as a  
45  
46 476 subjective indicator of actual exposure, the latter likely to be higher because of the  
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48 477 frequent and implicit nature of marketing, resulting in a probable underestimation of  
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50 478 exposure to marketing. Our measures may further underestimate exposure as such a  
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3 479 measure may be less reliable in a sample of children and adolescents due to poor recall,  
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5 480 and inability to recognize all forms of marketing (particularly in digital media) (61).  
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7  
8 481 This study is subject to limitations common to survey research. Respondents were  
9  
10 482 recruited using non-probability based sampling; therefore, although the data were  
11  
12 483 weighted by age group, sex, region, and ethnicity (except in Canada), the findings do not  
13  
14 484 provide nationally representative estimates. In addition, there were notably higher levels  
15  
16 485 of missing data for BMI in the UK. The measures used also have some limitations. For  
17  
18 486 example, time spent watching cable television vs. on streaming applications (Netflix,  
19  
20 487 Crave, Amazon Prime Video, etc.) was not distinguished in this study. The amount of  
21  
22 488 marketing exposure on cable television compared to streaming platforms is likely very  
23  
24 489 different, and this may play an important role in understanding the amount of exposure.  
25  
26 490 Additionally, children and adolescents retrospectively self-reported the estimated screen  
27  
28 491 time spent on each media channel rather than using a more objective approach, and this  
29  
30 492 may have been influenced by whether or not a parent was present when completing the  
31  
32 493 survey. This approach has not yet been validated in the literature, but nevertheless seems  
33  
34 494 comparable to self-report estimates from other surveys. Responses may not be precisely  
35  
36 495 accurate, and likely overestimate the absolute amount of screen time reported by youth as  
37  
38 496 the measure does not take into account simultaneous use of multiple screens.  
39  
40 497 Nevertheless, this tool allows for comparisons of the relative amount of exposure across  
41  
42 498 countries, as it is likely that the challenge of estimations, and associated error, would be  
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44 499 similar across countries. Lastly, the measures did not distinguish between recreational  
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46 500 screen time and screen time that was spent for school purposes (e.g., on websites).  
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## 53 501 **4.2 Policy implications**

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3 502 These results reinforce the need to implement restrictive policies on marketing of  
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5 503 unhealthy food and beverages targeting children and adolescents, not only on television  
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7 504 but also on digital media considering the widespread usage of social media platforms  
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9  
10 505 among children and adolescents across countries and the persuasiveness of marketing that  
11  
12 506 is often targeted. Future research examining the exposure to digital marketing to children,  
13  
14 507 as well as research modelling of the impact of potential policy measures, are likely to be  
15  
16 508 important in making the case for restricting less healthy food and beverage content via  
17  
18 509 these channels (62). This study also demonstrated the variety of media channels that are  
19  
20 510 being used by children and adolescents, even though their content may not be ‘child-  
21  
22 511 targeted’(63) (i.e., social media, websites, etc.) but are indeed ‘child appealing’(62, 64).  
23  
24 512 Almost all social media platforms (such as Instagram, Facebook and Snapchat) have a  
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26 513 minimum age of 13 to register (65-67), but nearly a quarter of children aged 8 to 11 years  
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28 514 have an account (68), demonstrating that self-imposed age-restrictions are not effective.  
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31 515 The association between use and self-reported exposure further demonstrates the need for  
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33 516 restrictions to limit exposure to this vulnerable age group.  
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37 517 The results of our study will be useful for future research as a baseline for comparison  
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39 518 with exposure to unhealthy food marketing after the implementation of marketing  
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41 519 policies, but also in comparing children’s and adolescent’s exposure to screen-based  
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43 520 media and marketing after important worldwide events leading to possible changes in  
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45 521 media consumption habits, such as the COVID-19 pandemic.  
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3 525 **Ethics statement**  
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5 526 The study was reviewed by and received ethics clearance through a University of  
6  
7 527 Waterloo Research Ethics Committee (ORE# 41477) and Laval University Ethics  
8  
9 528 Committee (#2021-318). All participants provided informed consent to take part.  
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15 530 **Contributorship statement**  
16

17 531 LV, CMW and DH designed research; CMW conducted research; EDP analyzed data and  
18  
19 532 wrote the paper; LV had primary responsibility for final content; MW, MPK, DH, CN,  
20  
21 533 CMW, XZ and LV reviewed and edited the manuscript. All authors read and approved  
22  
23 534 the final manuscript.  
24

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26  
27  
28 536 **Competing interests**  
29

30 537 None declared.  
31  
32

33 538

34  
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36

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38  
39 541 number available), with additional support from a Canadian Institutes of Health Research  
40  
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47 544 **Data availability statement**  
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49 545 Data are available upon reasonable request. Data are available directly from the  
50  
51 546 International Food Policy Study team on reasonable request (see  
52  
53 547 [www.foodpolicystudy.com](http://www.foodpolicystudy.com)).  
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## References

1. John DR. Consumer Socialization of Children : A Retrospective Look at Twenty-Five Years of Research. *Journal of Consumer Research* 1999;26(3):183-213. doi: <https://doi.org/10.1086/209559>.
2. Guest L. Brand loyalty revisited: A twenty-year report. *Journal of Applied Psychology* 1964;48(2):93-7. doi: 10.1037/h0046667.
3. Haryanto JO, Moutinho L, Coelho A. Is brand loyalty really present in the children's market? A comparative study from Indonesia, Portugal, and Brazil. *Journal of Business Research* 2016;69(10):4020-32. doi: 10.1016/j.jbusres.2016.06.013.
4. Taillie LS, Busey E, Stoltze FM, Dillman Carpentier FR. Governmental policies to reduce unhealthy food marketing to children. *Nutr Rev* 2019;77(11):787-816. doi: 10.1093/nutrit/nuz021.
5. Hastings G, McDermott, L., Angus, K., Stead, M., Thomson, S. The Extent, Nature and Effects of Food Promotion to Children : A Review of the Evidence - Technical Paper Prepared for the World Health Organization. 2006.
6. Sadeghirad B, Duhaney T, Motaghipisheh S, Campbell NR, Johnston BC. Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obes Rev* 2016;17(10):945-59. doi: 10.1111/obr.12445.
7. Smith R, Kelly B, Yeatman H, Boyland E. Food Marketing Influences Children's Attitudes, Preferences and Consumption: A Systematic Critical Review. *Nutrients* 2019;11(4). doi: 10.3390/nu11040875.
8. Wellard L, Chapman K, Wolfenden L, Dodds P, Hughes C, Wiggers J. Who is responsible for selecting children's fast food meals, and what impact does this have on energy content of the selected meals? *Nutrition & Dietetics* 2014;71(3):172-7.
9. World Health Organization. Tackling food marketing to children in a digital world : trans-disciplinary perspectives. 2016.
10. World Health Organization. A framework for implementing the set of recommendations on the marketing of foods and non-alcoholic beverages to children. 2012.
11. Tan L, Ng SH, Omar A, Karupaiah T. What's on YouTube? A Case Study on Food and Beverage Advertising in Videos Targeted at Children on Social Media. *Child Obes* 2018;14(5):280-90. doi: 10.1089/chi.2018.0037.
12. Coates AE, Hardman CA, Halford JCG, Christiansen P, Boyland EJ. Social Media Influencer Marketing and Children's Food Intake: A Randomized Trial. *Pediatrics* 2019;143(4). doi: 10.1542/peds.2018-2554.
13. Smit CR, Buijs L, van Woudenberg TJ, Bevelander KE, Buijzen M. The Impact of Social Media Influencers on Children's Dietary Behaviors. *Front Psychol* 2019;10:2975. doi: 10.3389/fpsyg.2019.02975.

14. Smith R, Kelly B, Yeatman H, Moore C, Baur L, King L, Boyland E, Chapman K, Hughes C, Bauman A. Advertising Placement in Digital Game Design Influences Children's Choices of Advertised Snacks: A Randomized Trial. *J Acad Nutr Diet* 2020;120(3):404-13. doi: 10.1016/j.jand.2019.07.017.
15. Goerg GM, Best, C., Shobowale, S., Koehler, J., Remy, N. Advertising on YouTube and TV : A Meta-analysis of Optimal Media-mix Planning. *Journal of Advertising Research* 2015;57:283-304.
16. Facebook for Business. Internet: <https://www.facebook.com/business/news/Ad-Week-UK> (accessed October 3 2021).
17. Ofcom. Children and Parents: Media Use and Attitudes Report. 2015.
18. Ofcom. Children and parents : Media Use and Attitudes Report. 2021.
19. Innocenti UOoR-. Growing up in a connected world. Florence, 2019.
20. Bragg MA, Pageot YK, Amico A, Miller AN, Gasbarre A, Rummo PE, Elbel B. Fast food, beverage, and snack brands on social media in the United States: An examination of marketing techniques utilized in 2000 brand posts. *Pediatr Obes* 2020;15(5):e12606. doi: 10.1111/ijpo.12606.
21. Rummo PE, Cassidy O, Wells I, Coffino JA, Bragg MA. Examining the Relationship between Youth-Targeted Food Marketing Expenditures and the Demographics of Social Media Followers. *Int J Environ Res Public Health* 2020;17(5). doi: 10.3390/ijerph17051631.
22. Potvin Kent M, Pauzé E, Roy EA, de Billy N, Czoli C. Children and adolescents' exposure to food and beverage marketing in social media apps. *Pediatr Obes* 2019;14(6):e12508. doi: 10.1111/ijpo.12508.
23. Kelly B, Bosward R, Freeman B. Australian Children's Exposure to, and Engagement With, Web-Based Marketing of Food and Drink Brands: Cross-sectional Observational Study. *J Med Internet Res* 2021;23(7):e28144. doi: 10.2196/28144.
24. Nieto C, Valero I, Buenrostro N, Álvarez K, García A, Mendoza B, Ordaz L, Tolentino-Mayo L, Barquera S. Children and Adolescents' Exposure to Digital Food and Beverage Marketing in Mexico During COVID-19 Times. *Curr Dev Nutr* 2021;5(Suppl 2):562-. doi: 10.1093/cdn/nzab043\_014.
25. Hammond D, White, C.M., Rynard, V.L., Vanderlee, L. International Food Policy Study: Technical Report - 2019 Youth Survey. University of Waterloo. 2021.
26. Favre-Martinoz F, Haziza, D., Beaumont, J-F. A method of determining the winsorization threshold, with an application to domain estimation. *Survey Methodology* 2015(Statistics Canada).
27. World Health Organization. BMI-for-age (5-19 years). 2021.
28. World Health Organization. WHO AnthroPlus for Personal Computers Manual : Software for assessing growth of the world's children and adolescents. 2009.
29. Read SH, Lewis SC, Halbesma N, Wild SH. Measuring the Association Between Body Mass Index and All-Cause Mortality in the Presence of Missing Data: Analyses From the Scottish National Diabetes Register. *Am J Epidemiol* 2017;185(8):641-9. doi: 10.1093/aje/kww162.
30. Hammond D. International Food Policy Study : 2019 Youth Survey - Canada. University of Waterloo. February 2021.

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  - 60
31. Rideout V, Robb, M.B. The common sense census: Media use by tweens and teens, 2019. In: Media CS, ed. San Francisco, CA, 2019.
32. Katapally TR, Laxer RE, Qian W, Leatherdale ST. Do school physical activity policies and programs have a role in decreasing multiple screen time behaviours among youth? *PrevMed* 2018;110:106-13.
33. American Academy of Pediatrics. Children, Adolescents, and the Media. *Pediatrics* 2013;132(5):958-61. doi: 10.1542/peds.2013-2656.
34. Canadian 24-Hour Movement Guidelines for Children and Youth. An Integration of Physical Activity, Sedentary Behaviour, and Sleep. 2021.
35. Sociedad Chilena de Pediatria. Ninos y dispositivos electronicos: lo bueno y lo malo de una exposicion inevitable. 2015.
36. Lissak G. Adverse physiological and psychological effects of screen time on children and adolescents: Literature review and case study. *Environ Res* 2018;164:149-57. doi: 10.1016/j.envres.2018.01.015.
37. Cox R, Skouteris H, Rutherford L, Fuller-Tyszkiewicz M, Dell' Aquila D, Hardy LL. Television viewing, television content, food intake, physical activity and body mass index: a cross-sectional study of preschool children aged 2-6 years. *Health Promot J Austr* 2012;23(1):58-62. doi: 10.1071/he12058.
38. Paisi M, Witton R, Plessas A. Is there an association between children's screen use and cariogenic diet? *Evid Based Dent* 2019;20(4):115-6. doi: 10.1038/s41432-019-0064-z.
39. Avery A, Anderson C, McCullough F. Associations between children's diet quality and watching television during meal or snack consumption: A systematic review. *Matern Child Nutr* 2017;13(4). doi: 10.1111/mcn.12428.
40. Andreyeva T, Kelly IR, Harris JL. Exposure to food advertising on television: Associations with children's fast food and soft drink consumption and obesity. *Economics & Human Biology* 2011;9(3):221-33. doi: 10.1016/j.ehb.2011.02.004.
41. Vassallo AJ, Kelly B, Zhang L, Wang Z, Young S, Freeman B. Junk Food Marketing on Instagram: Content Analysis. *JMIR Public Health Surveill* 2018;4(2):e54. doi: 10.2196/publichealth.9594.
42. Freeman B, Kelly B, Baur L, Chapman K, Chapman S, Gill T, King L. Digital Junk: Food and Beverage Marketing on Facebook. *AmJPublic Health* 2014;104(12):e56-e64. doi: 10.2105/AJPH.2014.302167.
43. Blades M, Oates C, Li S. Children's recognition of advertisements on television and on Web pages. *Appetite* 2013;62:190-3. doi: 10.1016/j.appet.2012.04.002.
44. Owen L, Lewis C, Auty S, Buijzen M. Is Children's Understanding of Nontraditional Advertising Comparable to Their Understanding of Television Advertising? *Journal of Public Policy & Marketing* 2013;32(2):195-206. doi: 10.1509/jppm.09.003.
45. Harris JL, Fleming-Milici, F., Phaneuf, L., Jensen, M., Choi, Y. Y., McCann, M., Mancini, S. Fast food advertising : Billions in spending, continued high exposure by youth. *Rudd Center for Food Policy and Obesity* 2021.
46. House of Commons Library. Advertising to children. 2021.

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47. Boyland EJ, Harrold JA, Kirkham TC, Halford JCG. The extent of food advertising to children on UK television in 2008. *International Journal of Pediatric Obesity* 2011;6(5-6):455-61. doi: 10.3109/17477166.2011.608801.
48. Adams J, Tyrrell R, Adamson AJ, White M. Effect of Restrictions on Television Food Advertising to Children on Exposure to Advertisements for 'Less Healthy' Foods: Repeat Cross-Sectional Study. *PLoS ONE* 2012;7(2):e31578. doi: 10.1371/journal.pone.0031578.
49. Council of Better Business Bureaus. The Children's Food and Beverage Advertising Initiative in Action : A Report on Compliance and Progress During 2016. 2017.
50. Harris JL, Kalnova SS. Food and beverage TV advertising to young children: Measuring exposure and potential impact. *Appetite* 2018;123:49-55. doi: 10.1016/j.appet.2017.11.110.
51. Fleming-Milici F, Harris JL. Food marketing to children in the United States: Can industry voluntarily do the right thing for children's health? *Physiol Behav* 2020;227:113139. doi: 10.1016/j.physbeh.2020.113139.
52. Department of Health and Social Care and Department for Digital C, Media and Sport,. Introducing a total online advertising restriction for products high in fat, sugar and salt (HFSS). 2021.
53. Mytton OT, Boyland E, Adams J, Collins B, O'Connell M, Russell SJ, Smith K, Stroud R, Viner RM, Cobiac LJ. The potential health impact of restricting less-healthy food and beverage advertising on UK television between 05.30 and 21.00 hours: A modelling study. *PLoS medicine* 2020;17(10):e1003212.
54. Adams J, Tyrrell R, Adamson AJ, White M. Socio-economic differences in exposure to television food advertisements in the UK: a cross-sectional study of advertisements broadcast in one television region. *Public Health Nutr* 2012;15(3):487-94.
55. Brownell KD, Schwartz MB, Puhl RM, Henderson KE, Harris JL. The need for bold action to prevent adolescent obesity. *J Adolesc Health* 2009;45(3 Suppl):S8-17. doi: 10.1016/j.jadohealth.2009.03.004.
56. Montgomery KC, Chester J. Interactive food and beverage marketing: targeting adolescents in the digital age. *J Adolesc Health* 2009;45(3 Suppl):S18-29. doi: 10.1016/j.jadohealth.2009.04.006.
57. Harris JL, Brownell KD, Bargh JA. The Food Marketing Defense Model: Integrating Psychological Research to Protect Youth and Inform Public Policy. *Soc Issues Policy Rev* 2009;3(1):211-71. doi: 10.1111/j.1751-2409.2009.01015.x.
58. Harris JL, Yokum S, Fleming-Milici F. Hooked on Junk: Emerging Evidence on How Food Marketing Affects Adolescents' Diets and Long-Term Health. *Current Addiction Reports* 2021;8(1):19-27. doi: 10.1007/s40429-020-00346-4.
59. Forde H, White M, Levy L, Greaves F, Hammond D, Vanderlee L, Sharp S, Adams J. The Relationship between Self-Reported Exposure to Sugar-Sweetened Beverage Promotions and Intake: Cross-Sectional Analysis of the 2017 International Food Policy Study. *Nutrients* 2019;11(12). doi: 10.3390/nu11123047.
60. Vanderlee L, Czoli CD, Pausé E, Potvin Kent M, White CM, Hammond D. A comparison of self-reported exposure to fast food and sugary drinks marketing



- 1  
2  
3 among parents of children across five countries. *Prev Med* 2021;147:106521. doi:  
4 10.1016/j.ypmed.2021.106521.  
5  
6 61. Tatlow-Golden M, Verdoodt V, Oates J, Jewell J, Breda JJ, Boyland E, Organization  
7 WH. A safe glimpse within the "black box"? ethical and legal principles when  
8 assessing digital marketing of food and drink to children. *Public health panorama*  
9 2017;3(04):613-21.  
10  
11 62. Tatlow-Golden M, Jewell J, Zhiteneva O, Wickramasinghe K, Breda J, Boyland E.  
12 Rising to the challenge: Introducing protocols to monitor food marketing to  
13 children from the World Health Organization Regional Office for Europe. *Obesity*  
14 *Reviews* 2021. doi: 10.1111/obr.13212.  
15  
16 63. Tatlow-Golden M, Garde A. Digital food marketing to children: Exploitation,  
17 surveillance and rights violations. *Global Food Security* 2020;27:100423.  
18  
19 64. World Cancer Research Fund International. How digital media markets unhealthy  
20 foods to children. 2017.  
21  
22 65. Snap Inc. Internet: <https://www.snap.com/en-US/terms> (accessed 3 October  
23 2021).  
24  
25 66. Instagram. Internet: <https://help.instagram.com/581066165581870#> (accessed 3  
26 October 2021).  
27  
28 67. Facebook. Internet: <https://www.facebook.com/help/157793540954833/>  
29 (accessed October 3 2021).  
30  
31 68. Ofcom. Children and Parents: Media Use and Attitudes Report. 2017.  
32  
33  
34  
35  
36  
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## TABLES

**Table 1.** Sample characteristics of children and adolescents in six countries (weighted) N = 9171.

Characteristic	All countries (N=9171)	Australia (n=1127)	Canada (n=2869)	Chile (n=1124)	Mexico (n=1505)	UK (n=1140)	USA (n=1406)
				% (n)			
<b>Age (years)</b>							
10-13	50 (4551)	51 (574)	50 (1438)	47 (534)	50 (750)	49 (562)	49 (693)
14-17	50 (4620)	49 (553)	50 (1431)	53 (590)	50 (755)	51 (578)	51 (713)
<b>Sex</b>							
Male	51 (4664)	52 (582)	50 (1446)	51 (572)	51 (761)	51 (581)	51 (722)
Female	49 (4507)	48 (545)	50 (1423)	49 (552)	49 (744)	49 (559)	49 (684)
<b>Ethnicity</b>							
Majority group	76 (6976)	75 (850)	73 (2098)	85 (958)	78 (1170)	83 (941)	68 (959)
Minority group	24 (2195)	25 (277)	27 (771)	15 (166)	22 (335)	17 (199)	32 (447)
<b>School grades</b>							
Low	16 (1461)	32 (365)	13 (373)	6 (65)	7 (101)	29 (334)	16 (223)
Mid	38 (3508)	38 (430)	34 (974)	49 (555)	36 (549)	38 (430)	41 (570)
High	46 (4202)	29 (332)	53 (1522)	45 (505)	57 (855)	33 (375)	44 (613)
<b>Perceived Income Adequacy</b>							
Inadequate	24 (2222)	25 (283)	17 (488)	31 (345)	28 (418)	26 (291)	28 (397)
Adequate	76 (6949)	75 (844)	83 (2381)	69 (779)	72 (1087)	74 (849)	72 (1009)
<b>BMI</b>							
Severe thinness/thinness/normal weight	49 (4480)	45 (509)	57 (1630)	43 (478)	48 (717)	41 (462)	49 (683)
Overweight	18 (1665)	16 (176)	16 (473)	21 (231)	22 (334)	13 (147)	22 (304)
Obesity	10 (927)	10 (113)	9 (255)	9 (97)	10 (148)	8 (92)	16 (222)
Not reported	23 (2100)	29 (328)	18 (511)	28 (319)	20 (306)	39 (439)	14 (197)

**Table 2.** Estimates from a linear regression model examining the amount of self-reported exposure to screen-based media (in minutes) on a weekday among children and adolescents in six countries (N=9171).

Parameter	Weekday screen time	
	Wald $\chi^2$	B (CI)
<b>Country</b>	64.2	
AUS vs. CAN		-18.1 (-47.2,11.0)
AUS vs. CHILE		-170.2 (-205.8,-134.5)
AUS vs. MEX		-144.3 (-179.3,-109.3)
AUS vs. UK		-26.8 (-60.7,7.2)
AUS vs. USA		-107.8 (-142.6,-72.9)
CAN vs. CHILE		-152.1 (-181.9,-122.3)
CAN vs. MEX		-126.2 (-154.9,-97.5)
CAN vs. UK		-8.7 (-37.7,20.3)
CAN vs. USA		-89.7 (-118.2,-61.1)
CHILE vs. MEX		25.8 (-9.1,60.8)
CHILE vs. UK		143.4 (107.9,178.9)
CHILE vs. USA		62.4 (26.7,98.0)
MEX vs. UK		117.6 (82.7,152.4)
MEX vs. USA		36.5 (1.9,71.2)
UK vs. USA		-81.0 (-116.1,-45.9)
<b>Sex</b>	25.3	
Female vs. male		-34.7 (-52.4,-16.9)
<b>Age</b>	209.4	
10-13 years vs. 14-17 years		-99.7 (-117.4,-81.9)
<b>Ethnicity</b>	18.5	
Majority vs. minority		-38.9 (-62.2,-15.6)
<b>Perceived income adequacy</b>	16.0	
Adequate vs. inadequate		-33.0 (-54.3,-11.8)
<b>School grades</b>	19.9	
High vs. low		-64.0 (-90.7,-37.2)
High vs. mid		-26.6 (-46.2,-7.0)
Low vs. mid		37.4 (10.6,64.1)
<b>BMI</b>	16.9	
Not reported vs. Obesity		-67.5 (-102.2,-32.8)
Not reported vs. Overweight		-28.8 (-57.2,-0.3)
Not reported vs. Severe thinness/thinness/normal weight		12.4 (-10.3,35.1)
Obesity vs. Overweight		38.7 (2.5,74.9)
Obesity vs. Severe thinness/thinness/normal weight		79.9 (47.8,112.0)
Overweight vs. Severe thinness/thinness/normal weight		41.2 (16.4,65.9)

\* : Indicates significant Wald  $\chi^2$  test.

**Notes:** The variable listed second is the reference variable.

**Abbreviations:** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; B=Beta; CI = 99% confidence interval.

**Table 3.** Estimates from separate logistic regression models examining self-reported exposure to social media platforms among children and adolescents in six countries (N=9171).

Parameter	Exposure to Facebook		Exposure to Instagram		Exposure to TikTok		Exposure to Twitter		Exposure to Snapchat		No exposure to social media	
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
Country	81.7		17.6		15.2		28.4		43.3		10.0	
AUS vs. CAN		1.28 (1.04,1.56)		0.90 (0.73,1.11)		0.80 (0.64,1.00)		0.92 (0.70,1.20)		0.77 (0.63,0.95)		1.29 (1.01,1.66)
AUS vs. CHILE		0.81 (0.63,1.04)		0.48 (0.37,0.62)		1.41 (1.07,1.86)		0.72 (0.52,0.99)		1.96 (1.50,2.56)		1.72 (1.25,2.36)
AUS vs. MEX		0.23 (0.18,0.30)		0.95 (0.74,1.21)		1.54 (1.15,2.04)		0.37 (0.28,0.50)		1.57 (1.22,2.03)		2.18 (1.57,3.03)
AUS vs. UK		0.89 (0.70,1.14)		0.82 (0.64,1.05)		1.05 (0.80,1.36)		0.54 (0.40,0.73)		0.62 (0.48,0.79)		1.59 (1.16,2.18)
AUS vs. USA		0.84 (0.66,1.06)		1.06 (0.83,1.35)		0.85 (0.66,1.09)		0.60 (0.44,0.81)		0.73 (0.57,0.92)		1.19 (0.89,1.60)
CAN vs. CHILE		0.64 (0.51,0.79)		0.53 (0.43,0.66)		1.76 (1.40,2.22)		0.78 (0.61,1.01)		2.53 (2.02,3.18)		1.33 (1.01,1.75)
CAN vs. MEX		0.18 (0.14,0.22)		1.05 (0.86,1.28)		1.92 (1.51,2.44)		0.41 (0.33,0.51)		2.03 (1.64,2.50)		1.69 (1.27,2.25)
CAN vs. UK		0.70 (0.56,0.87)		0.91 (0.73,1.12)		1.31 (1.04,1.64)		0.59 (0.46,0.76)		0.80 (0.65,0.98)		1.23 (0.93,1.63)
CAN vs. USA		0.66 (0.54,0.80)		1.17 (0.96,1.42)		1.06 (0.87,1.30)		0.65 (0.52,0.82)		0.94 (0.78,1.13)		0.92 (0.72,1.18)
CHILE vs. MEX		0.28 (0.22,0.37)		1.96 (1.54,2.51)		1.09 (0.82,1.46)		0.52 (0.40,0.68)		0.80 (0.61,1.05)		1.27 (0.91,1.78)
CHILE vs. UK		1.10 (0.85,1.42)		1.70 (1.32,2.19)		0.74 (0.56,0.98)		0.75 (0.56,1.01)		0.31 (0.24,0.41)		0.92 (0.66,1.30)
CHILE vs. USA		1.04 (0.81,1.32)		2.19 (1.71,2.80)		0.60 (0.46,0.79)		0.83 (0.63,1.10)		0.37 (0.29,0.48)		0.69 (0.51,0.95)
MEX vs. UK		3.91 (2.99,5.10)		0.86 (0.67,1.11)		0.68 (0.51,0.91)		1.46 (1.11,1.90)		0.39 (0.30,0.51)		0.73 (0.51,1.03)
MEX vs. USA		3.68 (2.86,4.73)		1.11 (0.88,1.42)		0.55 (0.42,0.73)		1.61 (1.25,2.07)		0.46 (0.36,0.59)		0.55 (0.40,0.75)
UK vs. USA		0.94 (0.74,1.20)		1.29 (1.01,1.66)		0.81 (0.63,1.05)		1.11 (0.83,1.46)		1.18 (0.93,1.50)		0.75 (0.54,1.04)
Sex	0.6		69.7		250.4		1.9		163.6		85.3	
Female vs. male		1.04 (0.92,1.18)		1.50 (1.33,1.71)		2.31 (2.02,2.65)		0.92 (0.80,1.07)		1.87 (1.65,2.12)		0.55 (0.47,0.65)
Age	601.2		705.2		30.1		380.7		406.4		588.0	
10-13 years vs. 14-17 years		0.30 (0.26,0.34)		0.27 (0.24,0.30)		1.34 (1.17,1.54)		0.31 (0.27,0.36)		0.37 (0.32,0.42)		6.24 (5.14,7.58)
Ethnicity	0.4		1.5		0.0		2.3		0.2		1.1	
Majority vs. minority		0.96 (0.82,1.13)		0.93 (0.79,1.09)		1.01 (0.85,1.20)		0.90 (0.74,1.08)		0.97 (0.83,1.14)		1.09 (0.88,1.34)
Perceived income adequacy	6.1		2.6		1.3		7.6		0.4		0.1	
Adequate vs. inadequate		0.87 (0.75,1.01)		1.10 (0.95,1.27)		0.93 (0.80,1.09)		1.20 (1.01,1.43)		0.96 (0.83,1.12)		1.02 (0.84,1.23)
School grades	11.1		2.3		10.2		2.1		7.3*		12.3	
High vs. low		0.80 (0.66,0.97)		0.98 (0.81,1.18)		0.73 (0.60,0.89)		1.20 (0.95,1.51)		0.83 (0.69,1.00)		1.42 (1.11,1.82)
High vs. mid		0.78 (0.68,0.90)		0.89 (0.78,1.03)		0.82 (0.71,0.96)		1.03 (0.88,1.21)		0.82 (0.72,0.95)		1.35 (1.13,1.61)
Low vs. mid		0.98 (0.81,1.18)		0.92 (0.76,1.11)		1.13 (0.93,1.38)		0.86 (0.68,1.08)		0.99 (0.82,1.19)		0.95 (0.74,1.22)
BMI	12.1		7.8		3.0		4.1		10.8		12.8	
Not reported vs. Obesity		0.64 (0.50,0.81)		0.74 (0.58,0.94)		0.78 (0.61,1.00)		0.77 (0.58,1.02)		0.71 (0.56,0.90)		1.86 (1.38,2.52)
Not reported vs. Overweight		0.72 (0.59,0.89)		0.74 (0.61,0.90)		0.85 (0.69,1.05)		0.78 (0.61,0.98)		0.69 (0.56,0.84)		1.59 (1.24,2.04)
Not reported vs. Severe thinness/thinness/normal weight		0.93 (0.79,1.10)		0.76 (0.65,0.90)		0.95 (0.80,1.13)		0.94 (0.77,1.15)		0.72 (0.61,0.85)		1.32 (1.09,1.62)
Obesity vs. Overweight		1.13 (0.88,1.45)		1.00 (0.78,1.28)		1.09 (0.84,1.41)		1.02 (0.77,1.35)		0.97 (0.76,1.24)		0.85 (0.62,1.18)
Obesity vs. Severe thinness/thinness/normal weight		1.46 (1.17,1.82)		1.03 (0.83,1.29)		1.22 (0.97,1.53)		1.23 (0.96,1.59)		1.02 (0.82,1.26)		0.71 (0.53,0.95)
Overweight vs. Severe thinness/thinness/normal weight		1.28 (1.08,1.53)		1.03 (0.87,1.23)		1.12 (0.93,1.34)		1.21 (1.00,1.48)		1.05 (0.88,1.24)		0.83 (0.66,1.05)

**Notes :** The variable listed second is the reference variable.

**Abbreviations :** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

**Table 4.** Estimates from separate logistic regression models examining daily self-reported exposure to sugary beverage and fast food advertisements among children and adolescents in six countries on a weekday (N=9171).

Parameter	Daily exposure to sugary drinks ads		Daily exposure to fast food ads	
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
<b>Country</b>	70.4*		24.3*	
AUS vs. CAN		0.89 (0.69,1.15)		0.89 (0.72,1.10)
AUS vs. CHILE		0.37 (0.28,0.49)		1.11 (0.86,1.43)
AUS vs. MEX		0.29 (0.22,0.38)		0.90 (0.70,1.15)
AUS vs. UK		1.77 (1.26,2.50)		2.00 (1.52,2.62)
AUS vs. USA		0.62 (0.47,0.81)		0.67 (0.52,0.84)
CAN vs. CHILE		0.41 (0.33,0.52)		1.24 (1.00,1.54)
CAN vs. MEX		0.33 (0.27,0.41)		1.00 (0.82,1.23)
CAN vs. UK		1.99 (1.47,2.70)		2.24 (1.76,2.84)
CAN vs. USA		0.69 (0.56,0.86)		0.75 (0.62,0.90)
CHILE vs. MEX		0.79 (0.62,1.00)		0.81 (0.63,1.03)
CHILE vs. UK		4.80 (3.46,6.67)		1.80 (1.36,2.39)
CHILE vs. USA		1.67 (1.30,2.14)		0.60 (0.47,0.76)
MEX vs. UK		6.07 (4.39,8.39)		2.23 (1.69,2.94)
MEX vs. USA		2.11 (1.66,2.68)		0.74 (0.59,0.94)
UK vs. USA		0.35 (0.25,0.48)		0.33 (0.26,0.43)
<b>Sex</b>	1.5		0.4	
Female vs. male		1.07 (0.93,1.23)		1.03 (0.91,1.17)
<b>Age</b>	0.0		1.2	
10-13 years vs. 14-17 years		1.00 (0.86,1.16)		0.95 (0.83,1.08)
<b>Ethnicity</b>	0.1		0.0	
Majority vs. minority		1.02 (0.85,1.23)		1.00 (0.85,1.18)
<b>Perceived income adequacy</b>	1.0		4.5	
Adequate vs. inadequate		0.94 (0.80,1.11)		0.88 (0.76,1.03)
<b>School grades</b>	0.4		3.2	
High vs. low		0.93 (0.75,1.17)		0.95 (0.79,1.15)
High vs. mid		0.96 (0.82,1.13)		0.87 (0.76,1.00)
Low vs. mid		1.03 (0.83,1.29)		0.92 (0.76,1.11)
<b>BMI</b>	6.3*		6.4*	
Not reported vs. Obesity		0.73 (0.56,0.95)		0.75 (0.59,0.94)
Not reported vs. Overweight		0.70 (0.56,0.88)		0.75 (0.61,0.92)
Not reported vs. Severe thinness/thinness/normal weight		0.79 (0.66,0.96)		0.78 (0.66,0.93)
Obesity vs. Overweight		0.96 (0.74,1.25)		1.01 (0.79,1.28)
Obesity vs. Severe thinness/thinness/normal weight		1.09 (0.86,1.38)		1.05 (0.85,1.30)
Overweight vs. Severe thinness/thinness/normal weight		1.14 (0.94,1.38)		1.04 (0.88,1.24)
<b>Exposure to screen based media (weekday)</b>	88.2*	1.05 (1.04,1.07)	121.4*	1.05 (1.04,1.07)

\* Indicates significant Wald  $\chi^2$  test.

**Note :** The variable listed second is the reference variable. Exposure to screen based media is expressed in minutes.

**Abbreviations:** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

## FIGURES

**Figure 1.** Mean hours of total screen time (including Youtube, social media, television, playing games and browsing) on a weekday among children and adolescents in six countries after winsorization (N=9171).

Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**Figure 2.** Percentage of children and adolescents in six countries using platforms of social media (Facebook; Instagram; TikTok; Twitter; Snapchat; None) (N=9171).

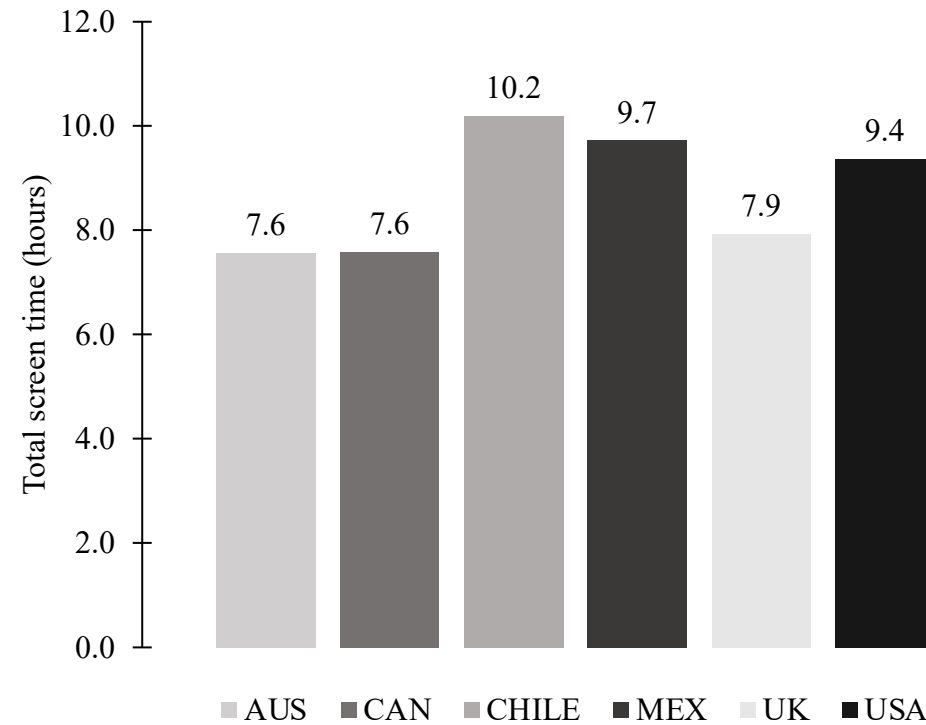
Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**Figure 3.** Percentage of children and adolescents in six countries self-reporting exposure to marketing for unhealthy foods or drinks in three locations (TV shows, series or movies; Website or social media; Video or computer games) in the last 30 days (N=9171).

Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**Figure 4.** Percentage of children and adolescents in six countries self-reporting daily exposure to marketing for sugary drinks and fast food in the last 30 days (N=9171).

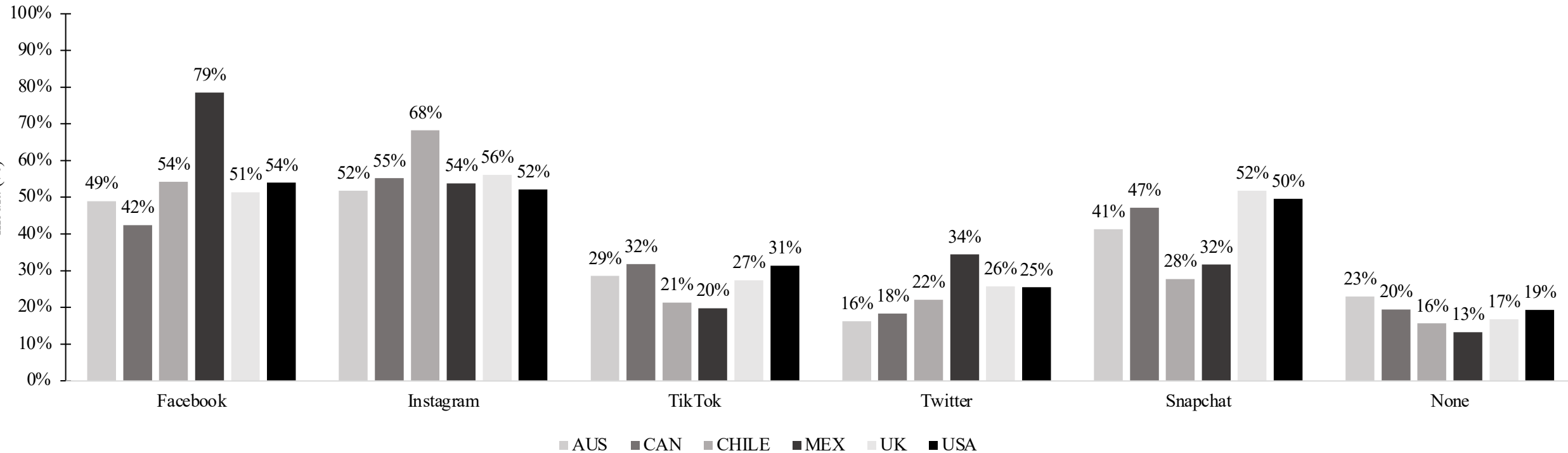
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**Figure 1.** Mean hours of total screen time (including Youtube, social media, television, playing games and browsing) on a weekday among children and adolescents in six countries after winsorization (N=9171).

Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

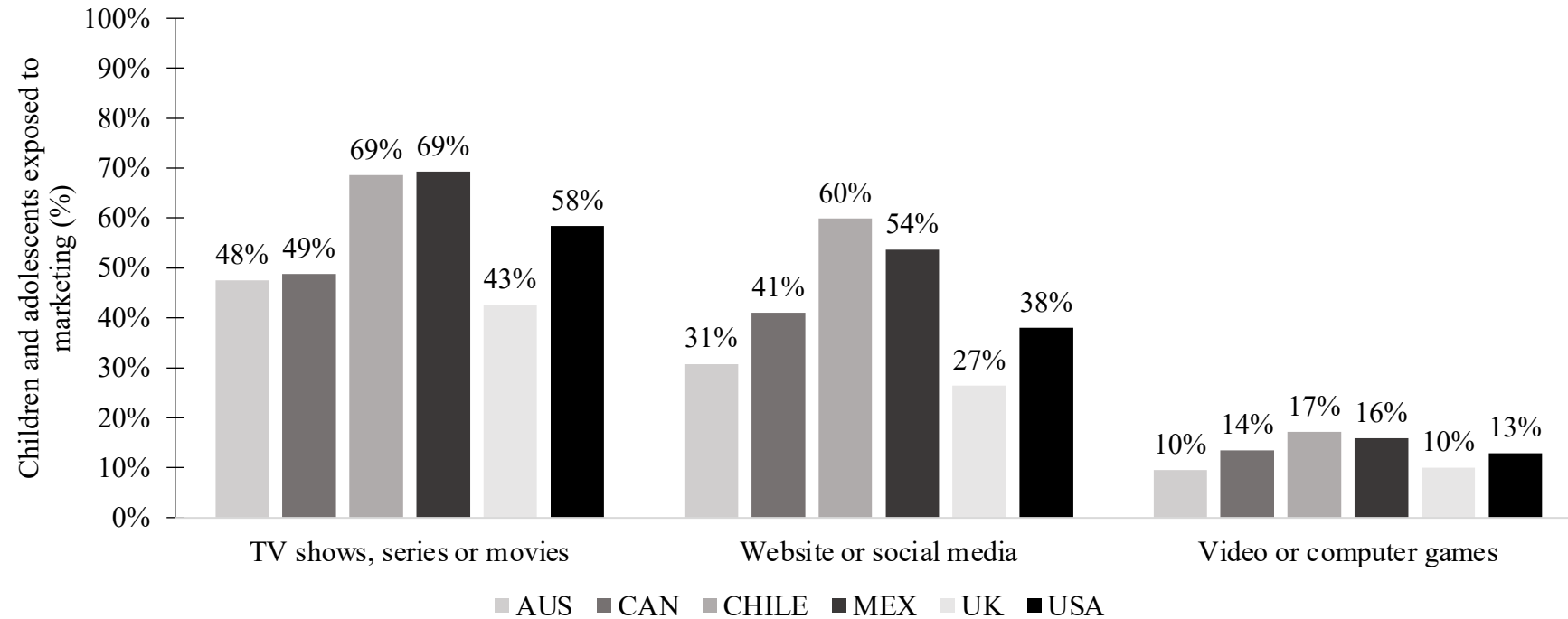
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**Figure 2.** Percentage of children and adolescents in six countries using platforms of social media (Facebook; Instagram; TikTok; Twitter; Snapchat; None) (N=9171).

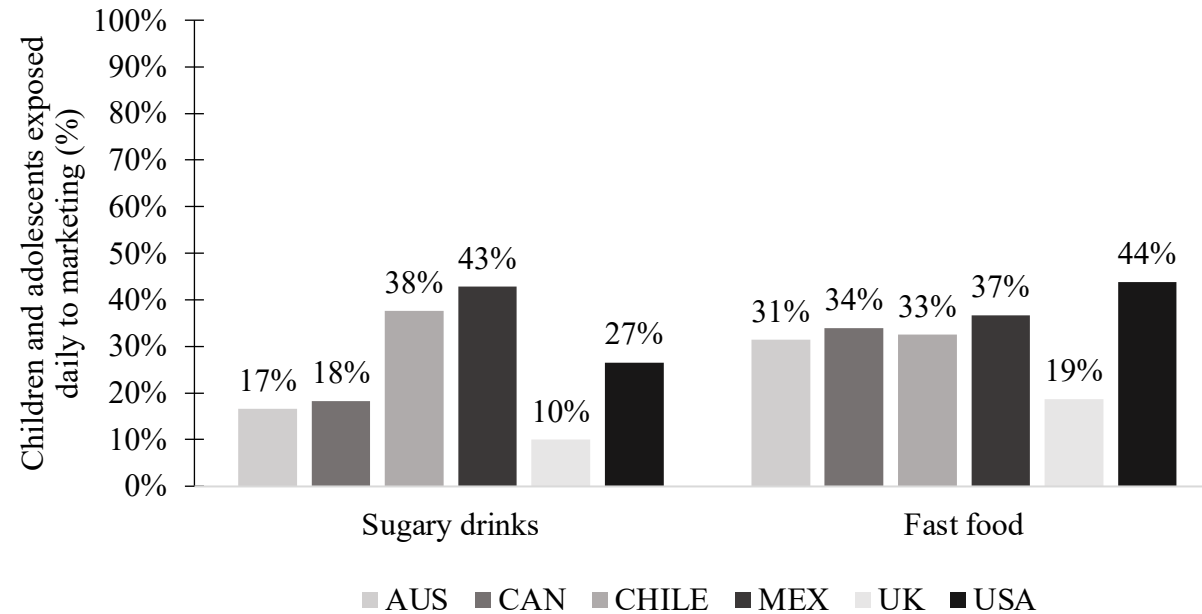
Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.





**Figure 3.** Percentage of children and adolescents in six countries self-reporting exposure to marketing for unhealthy foods or drinks in three locations (TV shows, series or movies; Website or social media; Video or computer games) in the last 30 days (N=9171).

Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.



**Figure 4.** Percentage of children and adolescents in six countries self-reporting daily exposure to marketing for sugary drinks and fast food in the last 30 days (N=9171).

Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**SUPPLEMENTARY MATERIAL - DEMERS-POTVIN ET AL.**

Children's and adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

**Supplementary Table S1.** Estimates from separate linear regression models examining the amount of self-reported exposure to screen-based media (in minutes) on a weekend day among children and adolescents in six countries (N=9171).

Parameter	Weekend day screen time	
	Wald $\chi^2$	B (CI)
<b>Country</b>	47.0*	
AUS vs. CAN		-6.8 (-35.7,22.0)
AUS vs. CHILE		-136.9 (-173.8,-100.0)
AUS vs. MEX		-130.0 (-165.4,-94.7)
AUS vs. UK		-26.7 (-60.8,7.4)
AUS vs. USA		-85.6 (-120.1,-51.1)
CAN vs. CHILE		-130.1 (-161.3,-98.8)
CAN vs. MEX		-123.2 (-152.1, -94.2)
CAN vs. UK		-19.8 (-48.7,9.0)
CAN vs. USA		-78.8 (-107.0,-50.6)
CHILE vs. MEX		6.9 (-29.7,43.5)
CHILE vs. UK		110.2 (73.4,147.1)
CHILE vs. USA		51.3 (14.5,88.1)
MEX vs. UK		103.3 (68.2,138.5)
MEX vs. USA		44.4 (9.6,79.2)
UK vs. USA		-58.9 (-93.8,-24.1)
<b>Sex</b>	15.0*	
Female vs. male		-27.0 (-44.9,-9.0)
<b>Age</b>	167.5*	
10-13 years vs. 14-17 years		-90.3 (-108.3,-72.4)
<b>Ethnicity</b>	13.0*	
Majority vs. minority		-32.9 (-56.3,-9.4)
<b>Perceived income adequacy</b>	32.0*	
Adequate vs. inadequate		-47.2 (-68.8,-25.7)
<b>School grades</b>	30.7*	
High vs. low		-79.7 (-106.7,-52.6)
High vs. mid		-35.8 (-55.6,-16.1)
Low vs. mid		43.8 (16.9,70.7)
<b>BMI</b>	10.7*	
Not reported vs. Obesity		-66.2 (-100.0,-32.4)
Not reported vs. Overweight		-20.6 (-48.6,7.4)
Not reported vs. Severe thinness/thinness/normal weight		-2.0 (-25.2,21.1)
Obesity vs. Overweight		45.6 (10.8,80.4)
Obesity vs. Severe thinness/thinness/normal weight		64.2 (32.9,95.5)
Overweight vs. Severe thinness/thinness/normal weight		18.6 (-5.9,43.0)

\* : Indicates significant Wald  $\chi^2$  test.

**Notes :** The variable listed second is the reference variable.

**Abbreviations :** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; B=Beta; CI = 99% confidence interval.

## SUPPLEMENTARY MATERIAL - DEMERS-POTVIN ET AL.

Children's and adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

**Supplementary Table S2.** Estimates from separate logistic regression models examining daily self-reported exposure to sugary beverage and fast food advertisements among children and adolescents in six countries on a weekend day (N=9171).

Parameter	Daily exposure to sugary drinks ads		Daily exposure to fast food ads	
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
<b>Country</b>	70.2*		24.8*	
AUS vs. CAN		0.88 (0.69,1.13)		0.88 (0.72,1.09)
AUS vs. CHILE		0.37 (0.28,0.49)		1.11 (0.86,1.44)
AUS vs. MEX		0.29 (0.22,0.39)		0.91 (0.71,1.17)
AUS vs. UK		1.78 (1.26,2.52)		2.02 (1.54,2.65)
AUS vs. USA		0.61 (0.47,0.81)		0.66 (0.52,0.84)
CAN vs. CHILE		0.42 (0.33,0.52)		1.26 (1.01,1.57)
CAN vs. MEX		0.33 (0.27,0.41)		1.03 (0.84,1.27)
CAN vs. UK		2.02 (1.49,2.75)		2.29 (1.80,2.90)
CAN vs. USA		0.70 (0.56,0.86)		0.75 (0.62,0.91)
CHILE vs. MEX		0.80 (0.63,1.02)		0.82 (0.64,1.05)
CHILE vs. UK		4.86 (3.50,6.76)		1.81 (1.37,2.40)
CHILE vs. USA		1.67 (1.30,2.15)		0.59 (0.47,0.76)
MEX vs. UK		6.08 (4.40,8.40)		2.22 (1.68,2.92)
MEX vs. USA		2.09 (1.64,2.66)		0.73 (0.58,0.92)
UK vs. USA		0.34 (0.25,0.48)		0.33 (0.25,0.43)
<b>Sex</b>	1.3		0.3	
Female vs. male		1.07 (0.92,1.23)		1.03 (0.91,1.17)
<b>Age</b>	0.0		0.7	
10-13 years vs. 14-17 years		1.01 (0.87,1.17)		0.96 (0.84,1.09)
<b>Ethnicity</b>	0.0		0.0	
Majority vs. minority		1.02 (0.85,1.23)		1.00 (0.85,1.18)
<b>Perceived income adequacy</b>	0.5		3.1	
Adequate vs. inadequate		0.95 (0.81,1.13)		0.90 (0.78,1.05)
<b>School grades</b>	0.1		2.7	
High vs. low		0.96 (0.77,1.20)		0.98 (0.81,1.19)
High vs. mid		0.98 (0.84,1.15)		0.89 (0.77,1.02)
Low vs. mid		1.02 (0.81,1.27)		0.90 (0.74,1.09)
<b>BMI</b>	6.3*		6.0*	
Not reported vs. Obesity		0.74 (0.57,0.96)		0.76 (0.60,0.96)
Not reported vs. Overweight		0.70 (0.56,0.87)		0.75 (0.61,0.92)
Not reported vs. Severe thinness/thinness/normal weight		0.81 (0.66,0.98)		0.79 (0.67,0.94)
Obesity vs. Overweight		0.94 (0.72,1.23)		0.99 (0.78,1.26)
Obesity vs. Severe thinness/thinness/normal weight		1.09 (0.86,1.38)		1.05 (0.85,1.30)
Overweight vs. Severe thinness/thinness/normal weight		1.16 (0.96,1.40)		1.06 (0.89,1.27)
<b>Exposure to screen based media (weekend day)</b>	128.7*	1.06 (1.05,1.08)	186.5*	1.07 (1.06,1.08)

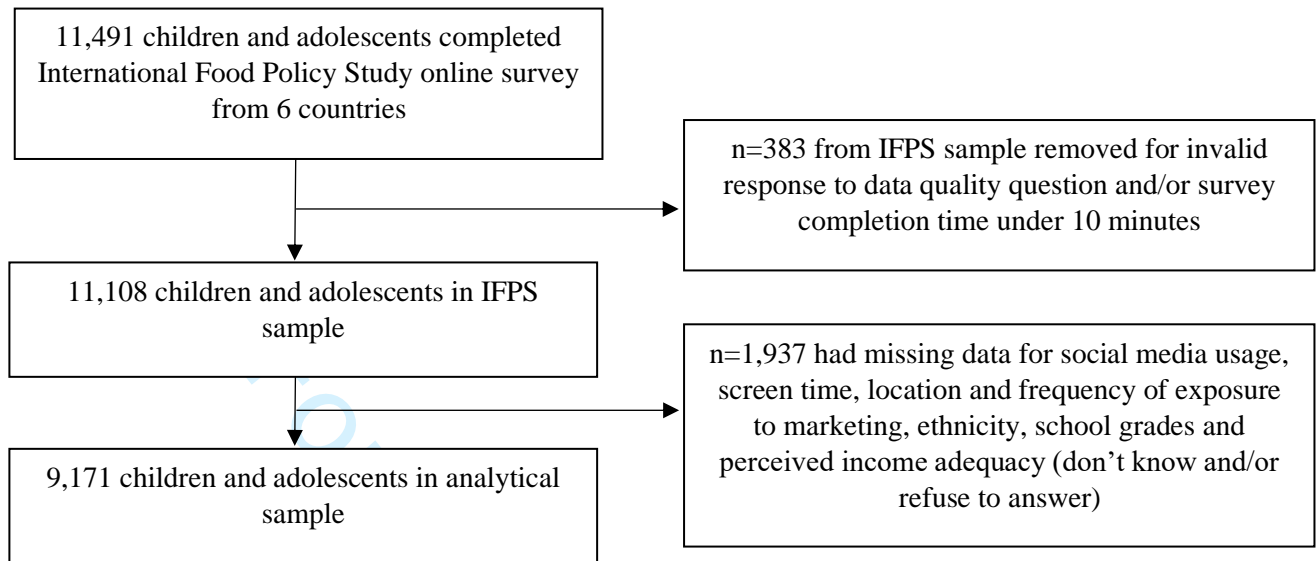
**Abbreviations :** CAN=Canada, AUS=Australia, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

\* : Indicates significant Wald  $\chi^2$  test.

**Notes :** The variable listed second is the reference variable. Exposure to screen based media is expressed in minutes.

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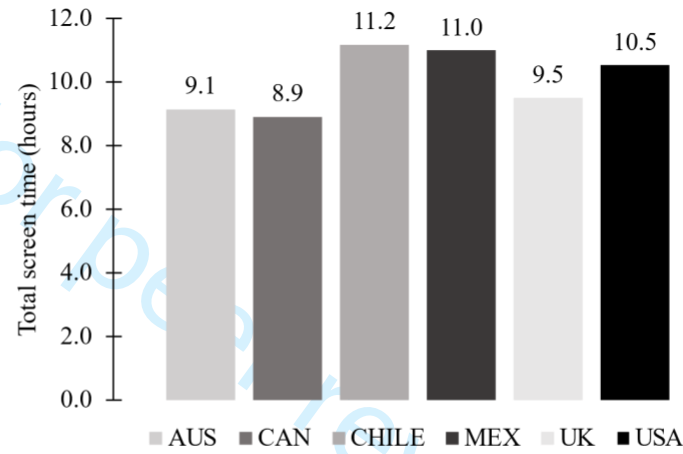
Children's and adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing



**Supplementary Figure S1. Flow chart of participants included in the analytical sample.**

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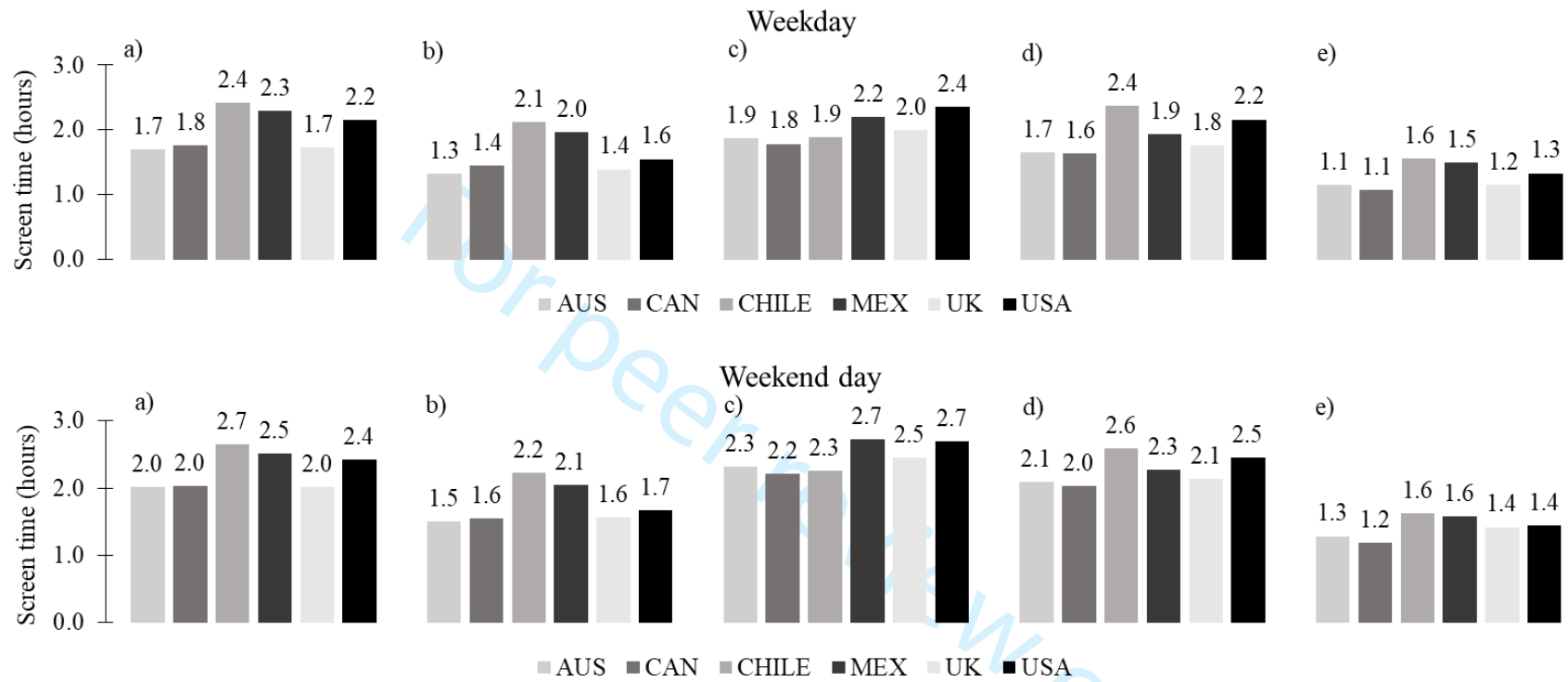


**Supplementary Figure S2.** Mean hours of total screen time (including Youtube, social media, television, playing games and browsing) on a weekend day among children and adolescents in six countries after winsorization (N=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

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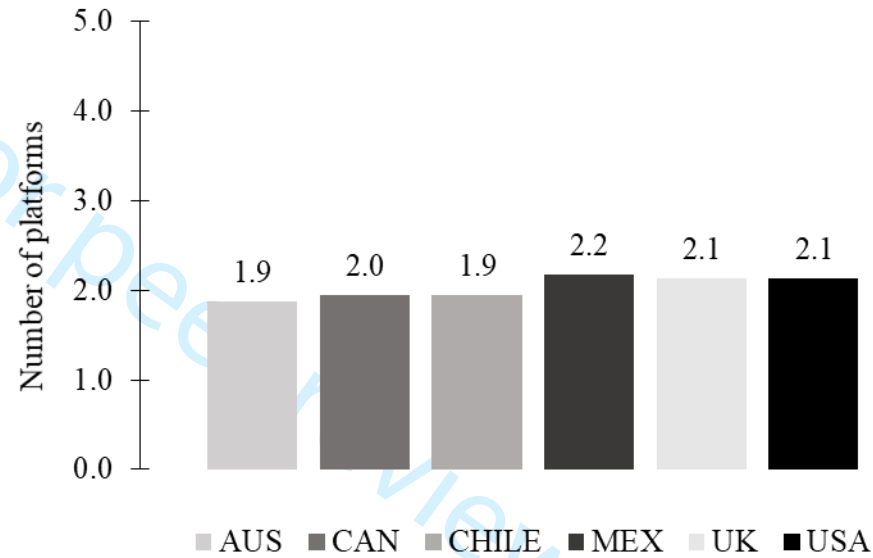
**Supplementary Figure S3.** Mean amount of screen time (in hours) for five media channels on a weekday (above) and weekend day (below) among children and adolescents in six countries before winsorization (N=9171).

- a) Watching YouTube
- b) On social media (including messaging, posting, or liking posts)
- c) Watching TV shows, series, or movies
- d) Playing games on smartphones, computers, or game consoles
- e) Browsing, reading websites, Googling, etc.

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**SUPPLEMENTARY MATERIAL - DEMERS-POTVIN ET AL.**

Children's and adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing



**Supplementary Figure S4.** Mean number of social media platforms used among children and adolescents in six countries (N=9171) <sup>a</sup>.

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

<sup>a</sup> Range of 0 to 5 possible social media platforms.



STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-11
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	12
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	12-13
		(b) Describe any methods used to examine subgroups and interactions	13
		(c) Explain how missing data were addressed	12
		(d) If applicable, describe analytical methods taking account of sampling strategy	13
		(e) Describe any sensitivity analyses	-
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	12
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	12, SFig 1
Outcome data	15*	Report numbers of outcome events or summary measures	14-16
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3

		(b) Report category boundaries when continuous variables were categorized	13
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	15
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	23-24
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-22
Generalisability	21	Discuss the generalisability (external validity) of the study results	24-25
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

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3 **Adolescents' media usage and self-reported exposure to advertising across six**  
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44 **Abbreviations**

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46 IFPS : International Food Policy Study  
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49 UK : United Kingdom  
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51 USA : United States of America  
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## 1 ABSTRACT

2 **Objectives:** The study objectives were to examine: 1) adolescents' media viewing habits;  
3 2) associations with media viewing and self-reported exposure to unhealthy food and  
4 beverage advertising; and 3) differences in trends among younger and older adolescents  
5 in six high and upper-middle income countries.

6 **Design:** Repeat cross-sectional online survey.

7 **Setting:** Australia, Canada, Chile, Mexico, the United Kingdom (UK) and the United  
8 States (USA).

9 **Participants:** Respondents to the International Food Policy Study (IFPS) who provided  
10 information on all variables of interest in November-December 2019 aged 10 to 17 years  
11 (n=9171).

12 **Outcome measures:** Self-reported exposure to screen-based media (screen time by  
13 media channel), use of social media platforms, and self-reported location and frequency  
14 of exposure to unhealthy food and beverage advertising.

15 **Results:** The average amount of time spent in front of various screens ranged from 7.6  
16 hours to 10.2 hours across countries per weekday, which may include possible viewing of  
17 multiple media channels simultaneously. Overall, Instagram was the most popular social  
18 media platform (52-68% by country), followed by Facebook (42-79%) and Snapchat (28-  
19 52%). The percentage of respondents who self-reported having seen unhealthy food  
20 advertisements in the past 30 days was highest on television (43-69%), followed by  
21 digital media (27-60%) and gaming applications (10-17%). Self-reported daily exposure  
22 to advertising varied between countries for sugary drinks (10-43%) and fast food (19-  
23 44%), and was positively associated with self-reported screen time. Self-reported

24 exposure to screen-based media and social media platforms differed by socio-  
25 demographic characteristics, and was higher among older adolescents than younger  
26 adolescents.

27 **Conclusions:** The large percentages of adolescents across all countries who report  
28 viewing screen-based media and social media usage, and high rates of self-reported  
29 advertising exposure, support the need for policies to restrict marketing of unhealthy food  
30 and beverages appealing to adolescents on screen-based media.

31  
32 **Keywords:** Food marketing; food policy; marketing to children; broadcast media; digital  
33 media; adolescents; food environment

### 35 **Article summary**

#### 36 **Strengths and limitations of this study**

- 37 • The study has a large sample size, and employs the same measures across  
38 countries, allowing justifiable comparisons between countries.
- 39 • Assessed self-reported exposure to a wide range of social media platforms, and  
40 differentiated locations of self-reported exposure to screen-based advertisements.
- 41 • Adolescents retrospectively self-reported the estimated screen time spent on each  
42 media channel rather than using a more objective approach.
- 43 • Self-reported exposure to marketing may result in an underestimation of exposure  
44 to marketing, and this study provides a conservative estimate.
- 45 • Time spent watching cable television vs. on streaming applications (Netflix,  
46 Crave, Amazon Prime Video, etc.) was not distinguished in this study.



## 1. Introduction

In recent decades, children and adolescents have become the targets of a variety of marketing techniques, many of which exploit their vulnerabilities. Children are most often not able to recognize the persuasive intent of marketing and may perceive it as entertainment, making them particularly susceptible to marketing content (1). Children and adolescents are a potentially important market segment, as effective marketing towards them can build early positive associations, create life-long consumers and brand relationships that extend into adulthood (2, 3). As such, the WHO and others have called for restrictions on marketing to children and younger adolescents of specific products (such as tobacco or vaping products and unhealthy foods or beverages) (4). Some jurisdictions, such as the province of Quebec (Canada), the UK, Chile and Mexico have implemented policies restricting unhealthy food marketing targeted at children and younger adolescents typically 13 years and under (5), as it is well established that food marketing influences children's and adolescents' dietary preferences for products, consumption patterns, and shapes their purchasing behavior as well as their purchase requests to parents (6-9).

Effective food marketing depends on both exposure (defined as the number of people seeing the message and the frequency to which the person is exposed to the message) and power (defined as the "creative content, design and execution of the marketing message"), which both vary considerably between media channels or types (4, 10). Various marketing techniques are used across media channels to optimize the effectiveness of marketing (8, 11-14), and may differ both in their impact on children and adolescents as well as whether or not children and adolescents can recognize them as

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3 70 marketing (15, 16). Screen-based media, which for the large part includes television,  
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5 71 digital media (including social media) and gaming sites, all have different implications  
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8 72 with regard to the exposure and power of marketing messages that reach their audience.  
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10 73 Companies are increasingly using digital platforms as a complement to traditional  
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12 74 advertising on television in a mixed-media approach to maximize the reach, efficiency  
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14 75 and effectiveness of marketing (17, 18). Globally, time spent online on social media,  
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16 76 gaming, streaming, and browsing the web is significant, and appears to be increasing in  
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18 77 some countries (19, 20), representing an important channel for advertising energy dense  
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20 78 and nutrient-poor products (21-25). Given the shifting media consumption habits of  
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22 79 children and adolescents, exploration of media consumption and associations with  
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24 80 exposure to marketing of less healthy food products, and their patterning by demographic  
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26 81 and socio-economic factors is warranted. Most studies to date that examine media  
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28 82 consumption habits among children and adolescents have been limited to a single media  
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30 83 type, and do not examine exposure across multiple countries. This study aimed to explore  
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32 84 adolescents' media consumption habits (self-reported screen time and use of social media  
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34 85 platforms) and associations with self-reported exposure to unhealthy food and beverage  
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36 86 advertisements (location and frequency) across six high and upper-middle income  
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38 87 countries (Australia, Canada, Chile, Mexico, UK and USA). As a secondary objective,  
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40 88 the study aimed to examine differences in trends among younger adolescents (10-13  
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42 89 years) and older adolescents (14-17 years), the latter of which often fall outside the  
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44 90 purview of policies restricting marketing of unhealthy food and beverages.  
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## 51 91 **2. Subjects and methods**

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3 92 Data are from the 2019 International Food Policy Study (IFPS) Youth Survey, an  
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5 93 annual repeat cross-sectional survey conducted in Australia, Canada, Chile, Mexico, the  
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7 94 UK and the USA. Data were collected via self-completed, web-based surveys conducted  
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9 95 in November-December 2019 with adolescents aged 10 to 17 years. According to the  
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11 96 World Health Organization (WHO), the period of adolescence is between 10 and 19 years  
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13 97 of age (26); participants will henceforth be referred to as younger adolescents (ages 10-  
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15 98 13) and older adolescents (14-17). Respondents were recruited through parents/guardians  
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17 99 enrolled in the Nielsen Consumer Insights Global Panel and their partners' panels. Email  
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19 100 invitations with unique survey links were sent to adult panelists within each country.  
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22 101 Those who confirmed they had a child aged 10 to 17 living in their household were asked  
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24 102 for permission for their child to complete the survey (only one child per household was  
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26 103 invited). Adolescents aged 10 to 17 years were eligible to participate, with quotas for age  
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28 104 and sex groups in the UK and USA. After eligibility screening, all potential respondents  
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30 105 were provided with information about the study and asked to provide assent. Surveys  
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32 106 were conducted in English in Australia and the UK; Spanish in Chile and Mexico;  
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34 107 English or French in Canada; and English or Spanish in the USA. Members of the  
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36 108 research team who were native in each language reviewed the French and Spanish  
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38 109 translations independently. The median survey time was 24 minutes.  
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44 110 The child's parent/guardian received remuneration in accordance with their panel's  
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46 111 usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes).  
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48 112 A full description of the study methods can be found in the International Food Policy  
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50 113 Study: Technical Report – 2019 Youth Survey at <http://foodpolicystudy.com/methods/>  
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52 114 (27).  
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## 115 **2.1 Total screen time and screen time by media channel and activity**

116 Self-reported daily screen time was measured using the question: “*On a normal*  
117 *weekday, how much time do you spend...?*” Participants were asked to answer this  
118 question for five different media channels and/or activities: YouTube, social media  
119 (including messaging, posting, or liking posts); TV (shows, series, or movies); playing  
120 games (on smartphones, computers, or game consoles); and browsing (reading websites,  
121 Googling, etc.). Responses for amount of screen time for each media channel were  
122 captured using a scale (none; up to 15 minutes; up to 30 minutes; up to 1 hour; up to 2  
123 hours; up to 3 hours; up to 4 hours; more than 4 hours; don’t know; refuse to answer).  
124 The same question was presented afterwards for a “normal weekend day”. Although the  
125 phrasing “up to” means that participants could have watched less than the stated value,  
126 the ceiling value was used to calculate an estimated amount of time in minutes spent on  
127 each media channel and all channels combined. For example, up to 15 minutes was  
128 recoded as 15 minutes, and up to 1 hour was recoded as 60 minutes. Those who  
129 responded “more than 4 hours” were recoded as 300 minutes (i.e., 5 hours). As  
130 adolescents could have been viewing multiple media channels simultaneously, the sum of  
131 exposure (i.e., total minutes across all media types) was used as an overall indicator of  
132 total amount of exposure to screen-based media. Winsorization was used to limit the  
133 effect of extreme values on total screen time . The maximum amount of total screen time  
134 was set at the mean + 2 SD, in this case 1195 minutes for a weekday and 1268 minutes  
135 for a weekend day. Participants (n=572, weekday (6.2%) and n=432, weekend day  
136 (4.7%)) who exceeded this value had their total screen time decreased to the maximum.  
137 The winsorization technique yielded a slightly higher cutoff (+73 minutes) for weekends,

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3 138 as might be expected. The maximum amount obtained using this method was compared  
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5 139 with a hypothetical estimation based on an assumption that on a weekday, children and  
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7 140 adolescents spend roughly 7 hours at school and 8 hours sleeping, which sums up to 15  
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9 141 hours. It is plausible that there may have been some screen time during school hours that  
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11 142 would fall within the aforementioned categories (browsing or watching YouTube), and so  
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13 143 it was assumed that this was approximately 1 hour. The total (14 hours) was subtracted  
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15 144 from the length of a day (24 hours) to give a possible maximum of 10 hours of screen  
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17 145 time, with a maximum of 20 hours if two screens were being used simultaneously. This  
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19 146 estimation of 20 hours (1200 minutes) confirms the measure of total maximal screen time  
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21 147 for weekdays (1195 minutes) and weekends (1268 minutes) has good face-validity.  
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## 26 148 **2.2 Usage of social media platforms**

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28 149 Self-reported usage of various social media platforms was assessed using the  
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30 150 measure: “Do you use...? (select all that apply)” (Response options: “Facebook”,  
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32 151 “Instagram”, “TikTok”, “Twitter”, “Snapchat”, “none of the above”, “don’t know” or  
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34 152 “refuse to answer”).  
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## 38 153 **2.3 Self-reported location of exposure to unhealthy food and beverage**

### 39 154 **advertisements**

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42 155 Self-reported location of exposure to advertisements was assessed using the question:  
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44 156 “Have you seen or heard advertisements for “unhealthy” foods or drinks in any of these  
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46 157 *places in the last 30 days?*” Participants were instructed “*Unhealthy food and drinks*  
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48 158 *include processed foods high in sugar, salt, or saturated fat, such as soda/pop, fast food,*  
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50 159 *chips, sugary cereals, cookies and chocolate bars.*” Participants could select all the  
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53 160 responses that applied from a list of 13 potential media channels, and an ‘other’ option  
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3 161 with an open-text box, or “I haven’t seen any ads for unhealthy food in the last 30 days”,  
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5 162 “don’t know” or “refuse to answer.” In this study, three channels were analyzed that  
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7 163 pertain to screen-based media (television shows, series or movies; website or social  
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9 164 media; and video or computer games). Open text data were reviewed, and responses were  
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11 165 re-coded to be included as one of the categorical options as applicable. “YouTube” and  
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13 166 “social media” were recoded to be included in the category “website or social media” and  
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15 167 “TV” was recoded in the category of television shows. When participants wrote “all” in  
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17 168 the open text, these responses were coded in each category of advertisement location.  
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## 22 169 **2.4 Self-reported frequency of exposure to unhealthy food and beverage**

### 23 170 **advertisements**

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26 171 Self-reported frequency of exposure to unhealthy food and beverage advertisements  
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28 172 was assessed using the question: “*In the last 30 days, how often did you see or hear*  
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30 173 *advertisements for these kinds of food or drinks?*” Participants responded for  
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32 174 advertisements for six food categories, two of which were included in this analysis  
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34 175 (sugary drinks; fast food from a restaurant). The frequency was assessed using a likert-  
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36 176 type scale. (Response options: “never”, “less than once a week”, “once a week”, “a few  
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38 177 times a week”, “everyday”, “more than once a day”, “don’t know” and “refuse to  
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40 178 answer”). Frequency of exposure was then recoded as a binary variable, where  
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42 179 “everyday” and “more than once a day” were combined as “daily”, and the other options  
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44 180 combined as “less than once a day”; responses of “don’t know” or “refused” were  
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46 181 considered as missing.  
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## 51 182 **2.5 Socio-demographic measures**

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3 183 Socio-demographic data included age, ethnicity, sex, country, school grades and  
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5 184 perceived income adequacy. Age was included as a binary variable (younger adolescents  
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7 185 aged 10 to 13 years, and older adolescents aged 14 to 17 years). Ethnicity was assessed  
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9 186 using unique measures from each country and recoded to derive comparable measures  
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11 187 across countries: *majority* or *minority* ethnicity. Participant's sex was self-reported by  
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13 188 asking "Are you..." with responses "male" or "female". School grades were measured  
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15 189 using the question: "What grades do you usually get in school?" Response options varied  
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17 190 across countries and were recoded to derive comparable measures across countries and  
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19 191 three groups were created: "low" (<grade of B in most countries), "mid" (grade of B in  
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21 192 most countries) or "high" grades (grade of A in most countries). Perceived income  
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23 193 adequacy was examined using the measure: "Does your family have enough money to pay  
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25 194 for things your family needs?" (Response options: "not enough money", "barely enough  
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27 195 money", "enough money", "more than enough money", "don't know" and "refuse to  
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29 196 answer"). Perceived income adequacy was recoded as a binary variable, (not enough  
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31 197 money/barely enough money were combined as "inadequate" and enough money/more  
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33 198 than enough money were combined as "adequate"); responses of "don't know" or  
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35 199 "refused" were considered as missing and excluded from analyses. Participant's body  
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37 200 mass index (BMI) was calculated using self-reported height and weight. BMI was  
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39 201 assessed using z-scores and classified according to the WHO recommendations (28).  
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41 202 *Severe thinness*, *thinness* and *normal weight* were combined considering low levels of  
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43 203 respondents for the *severe thinness and thinness* category (All countries = 2.9%,  
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45 204 Australia = 3.3%, Canada = 4.2%, Chile = 0.9%, Mexico = 1.7%, UK = 2.8%, US =  
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47 205 3.0%). Extreme values were recoded as missing (z-score < -5 or > 5) according to the  
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3 206 WHO growth reference guidelines (29). Extreme values as well as those participants  
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5 207 whose height and/or weight were missing were coded as “not reported” and included in  
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7 208 the analytic sample to reduce bias as potentially important differences between those who  
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9 209 do not report their height and weight in population-level surveys have been identified  
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11 210 (30). A full list of measures in each country is available at  
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13 211 <http://foodpolicystudy.com/methods/> in the surveys section (31). The questionnaire has  
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15 212 not been validated, but cognitive testing among a subsample of English-speaking  
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17 213 adolescents for various questions including screen time and exposure to advertisements  
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19 214 has been conducted to verify their understanding. When necessary, questions were  
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21 215 adapted to improve comprehension (unpublished data).

## 26 216 **2.6 Data analysis**

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28 217 A total of 11,491 adolescents completed the survey. Respondents were excluded for  
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30 218 the following reasons: region was missing, ineligible or had an inadequate sample size  
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32 219 (i.e., Canadian territories); invalid response to a data quality question; and/or survey  
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34 220 completion time under 10 minutes (n=383). The analytic sample included 11,108  
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36 221 respondents (Australia: n=1,435; Canada: n=3,682; Chile: n=1,252; Mexico: n=1,616;  
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38 222 UK: n=1,520; USA: n=1,603). A sub-sample (n=9,171) was included in the current  
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40 223 analysis after excluding respondents with missing data (including don't know and refuse  
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42 224 to answer) for social media usage, screen time, location and frequency of exposure to  
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44 225 unhealthy food and beverage advertisements, ethnicity, school grades and perceived  
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46 226 income adequacy (**Supplementary Figure S1**). Data were weighted with post-  
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48 227 stratification sample weights constructed using a raking algorithm with population  
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3 228 estimates from the census in each country based on age group, sex, region, and ethnicity  
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5 229 (except in Canada). Reported estimates are weighted.  
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8 230 Descriptive statistics were tabulated including the self-reported mean number of  
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10 231 hours viewing screen-based media across all channels and by channel on a weekday and  
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12 232 weekend day, the self-reported usage of each social media platform and mean number of  
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14 233 social media platforms (maximum of 5 platforms), the self-reported frequency of the  
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16 234 three advertisement locations and the percentage of respondents reporting being exposed  
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18 235 daily to advertisements for sugary drinks and fast food by country.  
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21 236 Regression models examined differences in the amount of self-reported exposure to  
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23 237 screen-based media between countries and population subgroups. First, linear regressions  
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25 238 were conducted with the amount of self-reported exposure to screen-based media (total  
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27 239 screen time in minutes) as the dependent variable, including an indicator variable for  
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29 240 country and age category (10-13 years, 14-17 years), adjusting for sex, ethnicity,  
30  
31 241 perceived income adequacy, school grades, and BMI. Next, separate logistic regression  
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33 242 models were conducted for each social media type (1=yes, 0=no), including an indicator  
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35 243 variable for country and age category, and adjusting for the same variables listed above.  
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37 244 Lastly, separate logistic regression analyses were used to examine associations between  
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39 245 the self-reported exposure to screen-based media and self-reported daily exposure to  
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41 246 advertisements for each of the food categories (sugary drinks; fast food from a  
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43 247 restaurant), with self-reported daily exposure to sugary drink or fast food marketing as  
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45 248 the dependent variable, including indicator variables for the amount of exposure on a  
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47 249 weekday (continuous) and country, adjusting for the same demographic correlates.  
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49 250 Separate models were tested for self-reported exposure to screen-based media on  
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3 251 weekends. For all regressions, survey-aware procedures were used to account for finite  
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5 252 sampling methods, and 99% confidence intervals are presented due to the use of multiple  
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8 253 comparisons. Analyses were conducted using SAS Studio 3.8.  
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## 10 254 **2.7 Patient and public involvement**

11  
12 255 Patients and the public were not involved in the design, conduct, analysis or  
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15 256 interpretation of the study. Study participants could have access to the study results upon  
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17 257 request.

## 18 19 258 **3. Results**

20  
21 259 Weighted sample characteristics are presented in **Table 1**. There were differences  
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23  
24 260 between countries in ethnicity group, school grades, perceived income adequacy and  
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26 261 BMI. In general, a greater percentage of participants identified as a minority group in the  
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28 262 USA, a smaller percentage had high school grades in Australia and the UK, and a greater  
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31 263 percentage perceived their family income as adequate in Canada.

### 32 33 264 **3.1 Self-reported exposure to screen-based media**

34  
35 265 **Figure 1** shows the mean amount of total self-reported screen time for a weekday  
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37 266 among participants across countries, which ranged from 7.6 hours (Canada and Australia)  
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39 267 to 10.2 hours (Chile). Similar findings were observed across countries for a weekend day,  
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41  
42 268 but with higher total amounts (**Supplementary Figure S2**). Time spent on various media  
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44 269 channels is shown in **Supplementary Figure S3**. Digital media, comprised of YouTube,  
45  
46 270 social media and browsing, reading websites and Googling, was the largest contributor  
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48  
49 271 overall. Across all countries, participants in Chile spent the highest amount of time on  
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51 272 YouTube, social media, playing games and browsing, while participants in the USA spent  
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54 273 the most time watching television on a weekday.  
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3 274 Estimates from a linear regression model examining the total amount of self-reported  
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5 275 exposure to screen-based media on a weekday across countries is shown in **Table 2**. Total  
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7 276 screen time differed by country, and across all demographic correlates. Participants in  
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9 277 Canada and Australia reported less screen time than those in Chile, Mexico and USA; and  
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11 278 Chilean participants reported more screen time than those in all other countries except  
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13 279 Mexico. Older adolescents spent more time on screens than younger adolescents. The  
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15 280 same pattern of results was observed for a weekend day (**Supplementary Table S1**).

### 19 281 **3.2 Self-reported social media exposure**

21 282 The percentage of participants self-reporting using different social media platforms  
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23 283 across countries is shown in **Figure 2**. Overall, 77% to 87% of adolescents were using at  
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25 284 least one of the social media platforms, which varied by country. On average, the most  
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27 285 commonly used platform was Instagram (range: from 52% in Australia and the USA to  
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29 286 68% in Chile), followed by Facebook (range: from 42% in Canada to 79% in Mexico),  
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31 287 and Snapchat (range: from 28% in Chile to 52% in the UK). Participants who reported no  
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33 288 social media application use ranged from 13% (Mexico) to 23% (Australia). After  
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35 289 stratifying self-reported social media usage by age category (**Supplementary Figure S4**),  
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37 290 usage was still common among younger adolescents (10-13 years), and TikTok usage  
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39 291 was more frequent among 10-13 than 14-17 year old adolescents in all countries. The  
40  
41 292 mean number of social media platforms used per respondent across countries is shown in  
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43 293 **Supplementary Figure S5**, and ranged from 1.9 platforms (Australia and Chile) to 2.2  
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45 294 platforms (Mexico).

51 295 Estimates from separate logistic regression models examining self-reported exposure  
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53 296 to social media platforms across countries are shown in **Table 3** and differed by country  
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3 297 and age group for all platforms. Specifically, participants in Canada were less likely to  
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5 298 use Facebook than those in all other countries, whereas participants in Mexico were more  
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7 299 likely to use Facebook than those in all other countries. Those in Chile were more likely  
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9 300 to use Instagram than those in all other countries. Participants from Canada were more  
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11 301 likely to use TikTok than participants in Australia, Chile, Mexico and the UK.  
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14 302 Participants in Mexico were more likely to use Twitter than participants in all other  
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16 303 countries, and those in the UK were more likely to use Snapchat than those in all other  
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18 304 countries except the USA. Participants in Australia were more likely to not use a social  
19  
20 305 media platform compared to all other countries except the USA. Older adolescents (ages  
21  
22 306 14-17) were more likely to use all social media platforms except TikTok compared to  
23  
24 307 younger adolescents (ages 10-13).

### 28 308 **3.3 Location of self-reported screen-based exposure to advertisements for unhealthy** 29 30 31 309 **foods or drinks**

32  
33 310 The percentage of adolescents who reported that they were exposed to advertisements  
34  
35 311 for unhealthy foods or drinks in three locations in the previous 30 days is shown in  
36  
37 312 **Figure 3**. Overall, TV shows, series or movies accounted for the largest number of  
38  
39 313 participants self-reporting exposure to advertisements (range: from 43% in the UK to  
40  
41 314 69% in Mexico and Chile), followed by websites or social media (range: from 27% in the  
42  
43 315 UK to 60% in Chile), and video or computer games (range: from 10% in Australia and  
44  
45 316 the UK to 17% in Chile).

### 49 317 **3.4 Self-reported daily exposure to sugary beverage and fast food advertisements**

50  
51 318 The percentage of respondents who reported that they were exposed daily to  
52  
53 319 advertisements for both food categories in the last 30 days is shown in **Figure 4**. Self-

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2  
3 320 reported daily exposure to sugary drinks advertisements ranged from 10% (UK) to 43%  
4  
5 321 (Mexico). Self-reported daily exposure to fast food advertisements was relatively more  
6  
7 322 consistent across countries, with the exception of the UK (range: from 19% in the UK to  
8  
9 323 44% in the USA).

10  
11  
12 324 Estimates from separate logistic regression models examining self-reported daily  
13  
14 325 exposure to sugary beverage and fast food advertisements across countries are shown in  
15  
16  
17 326 **Table 4.** Participants who self-reported more time spent on screen-based media were  
18  
19 327 more likely to report daily exposure to advertisements for both food categories. Self-  
20  
21 328 reported daily exposure to advertisements for sugary drinks and fast food differed by  
22  
23 329 country and amount of self-reported exposure to screen-based media (total screen time in  
24  
25 330 minutes), and patterns were mostly similar across both food categories; there was no  
26  
27 331 significant difference in self-reported exposure between age groups. Overall, participants  
28  
29 332 in Mexico and Chile were much more likely to report daily exposure to sugary beverage  
30  
31 333 advertisements than participants in all other countries, with fewer differences for fast  
32  
33 334 food advertisements. Participants in the UK were less likely to report daily exposure to  
34  
35 335 advertisements of sugary drinks and fast food compared to all other countries and those in  
36  
37 336 the USA were more likely to report daily exposure to fast food advertisements than those  
38  
39 337 in all other countries. The same pattern of results was observed for exposure to screen  
40  
41 338 based media on a weekend day (**Supplementary Table S2**).

#### 47 339 **4. Discussion**

##### 48 49 340 **Summary of main findings**

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51 341 This study found that adolescents across Australia, Canada, Chile, Mexico, UK and  
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53 342 USA are self-reporting considerable amounts of time viewing screen-based media,  
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3 343 although these self-reported estimates include simultaneous viewing of multiple media.  
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5 344 Digital media accounted for the most time on screens and social media use varied by  
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7  
8 345 platforms. Across all countries, self-reported exposure to advertisements in the past 30  
9  
10 346 days was most frequent on television, followed by digital media and gaming platforms.  
11  
12 347 Between-country differences were identified: participants in the UK reported less daily  
13  
14 348 exposure to fast food and sugary drinks advertisements, whereas participants in the USA  
15  
16 349 reported greater daily exposure to fast food advertisements. Most importantly, our results  
17  
18 350 show that in all countries, self-reported exposure to advertisements increased with greater  
19  
20 351 screen time. Analyses suggested important differences in self-reported exposure to  
21  
22 352 screen-based media and social media platforms between age groups, with older  
23  
24 353 adolescents generally reporting a greater exposure.  
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#### 28 354 **Relationships with existing knowledge**

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30  
31 355 The estimates from this study are similar to other international estimates of self-  
32  
33 356 reported screen time. In the US, screen time among children 8-12 years in 2019 was  
34  
35 357 estimated to be 4 hours 44 minutes, and 7 hours and 22 minutes among 13-18 year olds  
36  
37 358 (32), compared to over 9 hours in the current study among the older age group. A large  
38  
39 359 national Canadian study from 2013-2014 suggests that youth ages 13 to 18 spent on  
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41 360 average between 7.6 and 8 hours in front of screens daily (depending on province and  
42  
43 361 sex) (33), very similar to the current findings of approximately 8.5 hours among older  
44  
45 362 adolescents. However, the current estimates appear to be higher than several European  
46  
47 363 estimates from various countries (34), which may be due to differences in the types of  
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49 364 questions asked and the study context that may affect recall and self-report. Even with  
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53 365 limitations on the precision of screentime estimates due to self-report, most participants  
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3 366 in the current study exceeded screen time guidelines across countries, which recommend  
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5 367 entertainment screen time be limited to less than 2 hours daily for school-aged children  
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7  
8 368 and adolescents (35-37). Screen time has previously been associated with youth obesity  
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10 369 (38, 39), poorer diet quality (40), and consumption of less healthy foods and beverages  
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12 370 (41, 42). The general level of exposure reported among the sample, while an  
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15 371 approximation, is cause for concern.

16  
17 372 The large proportion of adolescents reporting using social media platforms has  
18  
19 373 important implications for food and beverage marketing. Companies are increasingly  
20  
21 374 developing strategies to engage with their audience through these media platforms, which  
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23  
24 375 have a high likelihood of reaching children and adolescents even when they are not the  
25  
26 376 primary target audience. Research from Canada has estimated that children ages 7-11  
27  
28 377 years were exposed to food and beverage marketing (of which the great majority is “less  
29  
30 378 healthy”) on social media apps 30 times per week while adolescents ages 12-16 years  
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33 379 were exposed on average 189 times per week (23). In our study, adolescents reported  
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35 380 using two social media platforms on average, therefore exposing them to various types  
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37  
38 381 and amounts of marketing strategies across platforms. For instance, Instagram—the most  
39  
40 382 commonly reported social media platform among participants—is known to promote  
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42 383 poor nutritional quality foods and are commonly promoted through popular brand  
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44  
45 384 accounts using a range of marketing strategies that appeal to a young audience, such as  
46  
47 385 competitions and the use of characters (43). Unhealthy food brands on Facebook are  
48  
49 386 known to use techniques such as competitions based on user-generated content,  
50  
51 387 interactive games, and apps (44).

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3 388 In this study, a greater proportion of adolescents reported exposure to advertisements  
4  
5 389 for unhealthy foods or drinks on television compared to websites, social media  
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7 390 applications or gaming sites. Greater reporting may be in part due to the different types of  
8  
9 391 advertising between these channels. In order for children and adolescents to be aware of  
10  
11 392 advertisements, they need to be able to identify the difference between an advertisement  
12  
13 393 and other content, but also understand the persuasive intent behind the message (15).  
14  
15 394 Self-reported exposure to advertisements on television may have been higher as it is more  
16  
17 395 easily identifiable compared to digital marketing which often uses subtle marketing  
18  
19 396 techniques (e.g. such as celebrity endorsements by influencers and native advertising  
20  
21 397 designed to imitate editorial content) and is frequently disguised as entertainment (15,  
22  
23 398 16). On digital media, adolescents may simply be less able to discriminate advertisements  
24  
25 399 from other content, making marketing on these channels particularly alarming. Digital  
26  
27 400 marketing via advertisements is typically targeted, using cookies and other means which  
28  
29 401 record personal preferences, online activity, and location and these data are then used to  
30  
31 402 personalize and target the content of marketing to individual users, therefore increasing  
32  
33 403 the persuasive power of marketing (10, 11). The subtle advertising techniques used on  
34  
35 404 digital media, such as influencer endorsements or advergames may be more likely to  
36  
37 405 bypass children's and younger adolescents' cognitive awareness. Our data align with  
38  
39 406 marketing expenditure data, an objective indicator of marketing efforts by companies:  
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41 407 fast-food advertisement expenditures are the highest for television, although digital  
42  
43 408 marketing expenditures increased by 74% between 2012 and 2019 (45). However, digital  
44  
45 409 marketing expenditures are likely underestimated as not all industry spending can be  
46  
47 410 captured and spending is not necessarily associated with the reach of the message on  
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3 411 digital media (46). Therefore, both self-reported exposure data and the general digital  
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5 412 marketing expenditure data likely underestimate the amount of digital marketing to which  
6  
7  
8 413 adolescents are currently exposed.

9  
10 414 Self-reported daily exposure to advertisements was common for both fast food and  
11  
12 415 sugary drinks, with 34% and 25% of the sample reporting daily exposure, respectively, in  
13  
14 416 all countries. Perhaps unsurprisingly, those reporting more screen time were more likely  
15  
16  
17 417 to report daily exposure to sugary drinks and fast food advertisements. Differences across  
18  
19 418 countries may in part relate to differences in restrictions on marketing directed at  
20  
21 419 children. In the UK, where participants were less likely to self-report daily exposure to  
22  
23 420 advertisements for fast food and sugary drinks than those in all other countries, a total  
24  
25 421 ban of advertisements for unhealthy foods and beverages has been in place since 2007  
26  
27 422 during and adjacent to television programs appealing to children and adolescents under  
28  
29 423 the age of 16 (47). The lower likelihood of self-reported exposure to advertisements  
30  
31 424 aligns with what would be expected with the UK's current policy in place, although  
32  
33 425 evidence on the impact of the UK policy is mixed. Findings suggest that despite some  
34  
35 426 changes in children's exposure, advertisements typically shifted to other media channels,  
36  
37 427 implying important loopholes in regulations (48, 49). In the USA, where participants  
38  
39 428 were more likely to report daily exposure to fast food advertisements than those in all  
40  
41 429 other countries, voluntary self-regulatory approaches to restrict marketing by the industry  
42  
43 430 are the only form of marketing restrictions, which target children under 12 years of age  
44  
45 431 on media where the audience is mostly children (50), and have largely proven ineffective  
46  
47 432 at decreasing children's exposure to marketing for unhealthy products (45, 51, 52). It is  
48  
49 433 important to note that the present study cannot capture the effectiveness of restrictive  
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3 434 marketing policies by its cross-sectional design, but studying trends in self-reported  
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5 435 screen-time, social media use and exposure to advertisements annually over time using  
6  
7 436 the IFPS should help evaluate the impact of impending policies, such as the recently  
8  
9 437 announced policy in the UK which will ban online advertising by the end of 2022 and  
10  
11 438 ban advertising of foods high in fat, sugar and salt between 5:30 am and 9 pm (53-55).

12  
13  
14 439 Age group was an important predictor for reported screen-based media and social  
15  
16 440 media exposure, with older adolescents reporting spending more time on screens and  
17  
18 441 using social media platforms more than younger adolescents. Older adolescents may be  
19  
20 442 an age group of particular interest to marketers because of their greater spending power  
21  
22 443 compared to younger adolescents, which also increases with age, therefore having the  
23  
24 444 potential to create life-long brand relationships and product consumers (56, 57).

25  
26 445 Marketers target adolescents through digital media by using “ubiquitous connectivity,  
27  
28 446 personalization, peer-to-peer networking, engagement, immersion and content creation”,  
29  
30 447 which are features especially appealing to this age group (57). In our study, there were no  
31  
32 448 differences in self-reported daily exposure to sugary drink and fast food advertisements  
33  
34 449 between age groups. Despite adolescents having an improved ability to recognize  
35  
36 450 advertisement content and the persuasive intent of marketing compared to children,  
37  
38 451 adolescents may be even more vulnerable to digital food marketing, because of their  
39  
40 452 increased use of these platforms as well as desire to conform with social norms in their  
41  
42 453 peer group (58, 59). Greater exposure to digital and social media platforms may also  
43  
44 454 increase the number of subtle marketing strategies, for example viral marketing (peer-to-  
45  
46 455 peer), contests, quizzes and marketing by influencers, which may not be captured in self-  
47  
48 456 report measures if the participant is unable to identify these as marketing strategies.  
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#### 4.1 Strengths and limitations

This study has a large sample size, and the same measures were used across countries, allowing justifiable comparisons between countries. Many studies use gross rating points or expenditure data as a proxy for exposure to advertising. While the latter provide objective data, they are unlikely to be accurate for digital advertising (46), and do not indicate who is exposed at the individual level, including individual-level correlates. More intensive approaches—such as devices that directly monitor websites or device usage—provide precise measures of exposure to marketing but are typically less feasible at a population level. One of the major strengths of this study is the wide range of social media platforms, and the differentiated locations of exposure to screen-based advertising assessed. Self-reported exposure to food marketing is a method used by researchers in large population samples (58, 60, 61) as a subjective indicator of actual exposure, although actual exposure is likely to be higher because of the frequent and implicit nature of marketing, resulting in a probable underestimation of exposure to marketing. Our measures may further underestimate exposure as such a measure may be less reliable in a sample of adolescents due to risk of recall errors, and inability to recognize all forms of marketing (particularly in digital media) (15).

This study is subject to limitations common to survey research. Respondents were recruited using non-probability based sampling; therefore, although the data were weighted by age group, sex, region, and ethnicity (except in Canada), the findings do not provide nationally representative estimates. In addition, there were notably higher levels of missing data for BMI in the UK. The measures used also have some limitations. For example, time spent watching cable television vs. on streaming applications (Netflix,

1  
2  
3 480 Crave, Amazon Prime Video, etc.) was not distinguished in this study. The amount of  
4  
5 481 marketing exposure on cable television and free streaming websites compared to  
6  
7 482 subscription platforms (that are typically ad-free) is likely very different, and this may  
8  
9 483 play an important role in understanding the amount of exposure. Additionally,  
10  
11 484 adolescents retrospectively self-reported the estimated screen time spent on each media  
12  
13 485 channel rather than using a more objective approach, and this may have been influenced  
14  
15 486 by whether or not a parent was present when completing the survey. This approach has  
16  
17 487 not yet been validated in the literature, but nevertheless seems comparable to self-report  
18  
19 488 estimates from other surveys. Responses may not be precisely accurate, and likely  
20  
21 489 overestimate the absolute amount of screen time reported by youth as overall exposure  
22  
23 490 was calculated by summing self-reported exposure to individual media channels and thus  
24  
25 491 may include simultaneous use of multiple screens. Indicators of simultaneous viewing of  
26  
27 492 screens were not directly measured in the survey. Nevertheless, this tool allows for  
28  
29 493 comparisons of the relative amount of exposure across countries, as it is likely that the  
30  
31 494 challenge of estimations, and associated error, would be similar across countries. Lastly,  
32  
33 495 the measures did not distinguish between recreational screen time and screen time that  
34  
35 496 was spent for school purposes (e.g., on websites).

#### 497 **4.2 Policy implications**

498 These results reinforce the need to implement restrictive policies on marketing of  
499 unhealthy food and beverages appealing to a young audience, not only on television but  
500 also on digital media considering the widespread self-reported usage of social media  
501 platforms among adolescents across countries and the persuasiveness of marketing that is  
502 often targeted. Future research examining children's and adolescents' exposure to digital

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3 503 marketing, as well as research modelling of the impact of potential policy measures, are  
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5 504 likely to be important in making the case for restricting less healthy food and beverage  
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7 505 content via these channels (62). This study also demonstrated the variety of media  
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9  
10 506 channels that are being used by adolescents, even though their content may not be ‘child-  
11  
12 507 targeted’(63) (i.e., social media, websites, etc.) but are indeed ‘child appealing’(62, 64).  
13  
14 508 Almost all social media platforms (such as Instagram, Facebook and Snapchat) have a  
15  
16 509 minimum age of 13 to register (65-67), but previous research has suggested that nearly a  
17  
18 510 quarter of children aged 8 to 11 years have an account (68), demonstrating that self-  
19  
20 511 imposed age-restrictions are not effective. Our results were similar, with the younger  
21  
22 512 adolescents (10-13 years) self-reporting widespread usage of social media platforms. The  
23  
24 513 high rates of social media usage and self-reported exposure to advertisements via this  
25  
26 514 medium further demonstrates the need for restrictions to limit exposure to this vulnerable  
27  
28 515 age group.  
29  
30  
31 516 The results of this study will be useful for future research as a baseline for comparison  
32  
33 517 with exposure to less healthy food marketing after the implementation of marketing  
34  
35 518 policies, but also in comparing adolescents’ exposure to screen-based media and  
36  
37 519 marketing after important worldwide events leading to possible changes in media  
38  
39 520 consumption habits, such as changes in exposure as a result of the COVID-19 pandemic  
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41 521 (69).  
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3 526 **Ethics statement**  
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5 527 The study was reviewed by and received ethics clearance through a University of  
6  
7 528 Waterloo Research Ethics Committee (ORE# 41477) and Laval University Ethics  
8  
9 529 Committee (#2021-318). All participants provided informed consent to take part.  
10  
11

12 530

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14  
15 531 **Contributorship statement**  
16

17 532 LV, CMW and DH designed research; CMW conducted research; EDP analyzed data and  
18  
19 533 wrote the paper; LV had primary responsibility for final content; MW, MPK, DH, CN,  
20  
21 534 CMW, XZ and LV reviewed and edited the manuscript. All authors read and approved  
22  
23 535 the final manuscript.  
24

25 536

26  
27  
28 537 **Competing interests**  
29

30 538 None declared.  
31  
32

33 539

34  
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47 545 **Data availability statement**  
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49 546 Data are available upon reasonable request. Data are available directly from the  
50  
51 547 International Food Policy Study team on reasonable request (see  
52  
53 548 [www.foodpolicystudy.com](http://www.foodpolicystudy.com)).  
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## References

1. John DR. Consumer Socialization of Children : A Retrospective Look at Twenty-Five Years of Research. *Journal of Consumer Research* 1999;26(3):183-213. doi: <https://doi.org/10.1086/209559>.
2. Guest L. Brand loyalty revisited: A twenty-year report. *Journal of Applied Psychology* 1964;48(2):93-7. doi: 10.1037/h0046667.
3. Haryanto JO, Moutinho L, Coelho A. Is brand loyalty really present in the children's market? A comparative study from Indonesia, Portugal, and Brazil. *Journal of Business Research* 2016;69(10):4020-32. doi: 10.1016/j.jbusres.2016.06.013.
4. World Health Organization. A framework for implementing the set of recommendations on the marketing of foods and non-alcoholic beverages to children. 2012.
5. Taillie LS, Busey E, Stoltze FM, Dillman Carpentier FR. Governmental policies to reduce unhealthy food marketing to children. *Nutr Rev* 2019;77(11):787-816. doi: 10.1093/nutrit/nuz021.
6. Hastings G, McDermott, L., Angus, K., Stead, M., Thomson, S. The Extent, Nature and Effects of Food Promotion to Children : A Review of the Evidence - Technical Paper Prepared for the World Health Organization. 2006.
7. Sadeghirad B, Duhaney T, Motaghipisheh S, Campbell NR, Johnston BC. Influence of unhealthy food and beverage marketing on children's dietary intake and preference: a systematic review and meta-analysis of randomized trials. *Obes Rev* 2016;17(10):945-59. doi: 10.1111/obr.12445.
8. Smith R, Kelly B, Yeatman H, Boyland E. Food Marketing Influences Children's Attitudes, Preferences and Consumption: A Systematic Critical Review. *Nutrients* 2019;11(4). doi: 10.3390/nu11040875.
9. Wellard L, Chapman K, Wolfenden L, Dodds P, Hughes C, Wiggers J. Who is responsible for selecting children's fast food meals, and what impact does this have on energy content of the selected meals? *Nutrition & Dietetics* 2014;71(3):172-7.
10. World Health Organization. Tackling food marketing to children in a digital world : trans-disciplinary perspectives. 2016.
11. Tan L, Ng SH, Omar A, Karupaiah T. What's on YouTube? A Case Study on Food and Beverage Advertising in Videos Targeted at Children on Social Media. *Child Obes* 2018;14(5):280-90. doi: 10.1089/chi.2018.0037.
12. Coates AE, Hardman CA, Halford JCG, Christiansen P, Boyland EJ. Social Media Influencer Marketing and Children's Food Intake: A Randomized Trial. *Pediatrics* 2019;143(4). doi: 10.1542/peds.2018-2554.
13. Smit CR, Buijs L, van Woudenberg TJ, Bevelander KE, Buijzen M. The Impact of Social Media Influencers on Children's Dietary Behaviors. *Front Psychol* 2019;10:2975. doi: 10.3389/fpsyg.2019.02975.

14. Smith R, Kelly B, Yeatman H, Moore C, Baur L, King L, Boyland E, Chapman K, Hughes C, Bauman A. Advertising Placement in Digital Game Design Influences Children's Choices of Advertised Snacks: A Randomized Trial. *J Acad Nutr Diet* 2020;120(3):404-13. doi: 10.1016/j.jand.2019.07.017.
15. Blades M, Oates C, Li S. Children's recognition of advertisements on television and on Web pages. *Appetite* 2013;62:190-3. doi: 10.1016/j.appet.2012.04.002.
16. Owen L, Lewis C, Auty S, Buijzen M. Is Children's Understanding of Nontraditional Advertising Comparable to Their Understanding of Television Advertising? *Journal of Public Policy & Marketing* 2013;32(2):195-206. doi: 10.1509/jppm.09.003.
17. Goerg GM, Best, C., Shobowale, S., Koehler, J., Remy, N. Advertising on YouTube and TV : A Meta-analysis of Optimal Media-mix Planning. *Journal of Advertising Research* 2015;57:283-304.
18. Facebook for Business. Internet: <https://www.facebook.com/business/news/Ad-Week-UK> (accessed October 3 2021).
19. Ofcom. Children and Parents: Media Use and Attitudes Report. 2015.
20. Ofcom. Children and parents : Media Use and Attitudes Report. 2021.
21. Bragg MA, Pageot YK, Amico A, Miller AN, Gasbarre A, Rummo PE, Elbel B. Fast food, beverage, and snack brands on social media in the United States: An examination of marketing techniques utilized in 2000 brand posts. *Pediatr Obes* 2020;15(5):e12606. doi: 10.1111/ijpo.12606.
22. Rummo PE, Cassidy O, Wells I, Coffino JA, Bragg MA. Examining the Relationship between Youth-Targeted Food Marketing Expenditures and the Demographics of Social Media Followers. *Int J Environ Res Public Health* 2020;17(5). doi: 10.3390/ijerph17051631.
23. Potvin Kent M, Pauzé E, Roy EA, de Billy N, Czoli C. Children and adolescents' exposure to food and beverage marketing in social media apps. *Pediatr Obes* 2019;14(6):e12508. doi: 10.1111/ijpo.12508.
24. Kelly B, Bosward R, Freeman B. Australian Children's Exposure to, and Engagement With, Web-Based Marketing of Food and Drink Brands: Cross-sectional Observational Study. *J Med Internet Res* 2021;23(7):e28144. doi: 10.2196/28144.
25. Nieto C, Valero I, Buenrostro N, Álvarez K, García A, Mendoza B, Ordaz L, Tolentino-Mayo L, Barquera S. Children and Adolescents' Exposure to Digital Food and Beverage Marketing in Mexico During COVID-19 Times. *Curr Dev Nutr* 2021;5(Suppl 2):562-. doi: 10.1093/cdn/nzab043\_014.
26. World Health Organization. Internet: <https://apps.who.int/adolescent/second-decade/section2/page1/recognizing-adolescence.html>.
27. Hammond D, White, C.M., Rynard, V.L., Vanderlee, L. International Food Policy Study: Technical Report - 2019 Youth Survey. University of Waterloo. 2021.
28. World Health Organization. BMI-for-age (5-19 years). 2021.
29. World Health Organization. WHO AnthroPlus for Personal Computers Manual : Software for assessing growth of the world's children and adolescents. 2009.
30. Read SH, Lewis SC, Halbesma N, Wild SH. Measuring the Association Between Body Mass Index and All-Cause Mortality in the Presence of Missing Data: Analyses



- 1  
2  
3 From the Scottish National Diabetes Register. *Am J Epidemiol* 2017;185(8):641-9.  
4 doi: 10.1093/aje/kww162.  
5  
6 31. Hammond D. International Food Policy Study : 2019 Youth Survey - Canada.  
7 University of Waterloo. February 2021.  
8  
9 32. Rideout V, Robb, M.B. The common sense census: Media use by tweens and teens,  
10 2019. In: *Media CS*, ed. San Francisco, CA, 2019.  
11  
12 33. Katapally TR, Laxer RE, Qian W, Leatherdale ST. Do school physical activity policies  
13 and programs have a role in decreasing multiple screen time behaviours among  
14 youth? *PrevMed* 2018;110:106-13.  
15  
16 34. European Commission. Directorate-General for Health and Food Safety. Study on  
17 the exposure of children to linear, non-linear and online marketing of foods high  
18 in fat, salt or sugar : final report. 2021.  
19  
20 35. American Academy of Pediatrics. Children, Adolescents, and the Media. *Pediatrics*  
21 2013;132(5):958-61. doi: 10.1542/peds.2013-2656.  
22  
23 36. Canadian 24-Hour Movement Guidelines for Children and Youth. An Integration of  
24 Physical Activity, Sedentary Behaviour, and Sleep. 2021.  
25  
26 37. Sociedad Chilena de Pediatria. Ninos y dispositivos electronicos: lo bueno y lo malo  
27 de una exposicion inevitable. 2015.  
28  
29 38. Lissak G. Adverse physiological and psychological effects of screen time on  
30 children and adolescents: Literature review and case study. *Environ Res*  
31 2018;164:149-57. doi: 10.1016/j.envres.2018.01.015.  
32  
33 39. Cox R, Skouteris H, Rutherford L, Fuller-Tyszkiewicz M, Dell' Aquila D, Hardy LL.  
34 Television viewing, television content, food intake, physical activity and body mass  
35 index: a cross-sectional study of preschool children aged 2-6 years. *Health Promot*  
36 *J Austr* 2012;23(1):58-62. doi: 10.1071/he12058.  
37  
38 40. Paisi M, Witton R, Plessas A. Is there an association between children's screen use  
39 and cariogenic diet? *Evid Based Dent* 2019;20(4):115-6. doi: 10.1038/s41432-019-  
40 0064-z.  
41  
42 41. Avery A, Anderson C, McCullough F. Associations between children's diet quality  
43 and watching television during meal or snack consumption: A systematic review.  
44 *Matern Child Nutr* 2017;13(4). doi: 10.1111/mcn.12428.  
45  
46 42. Andreyeva T, Kelly IR, Harris JL. Exposure to food advertising on television:  
47 Associations with children's fast food and soft drink consumption and obesity.  
48 *Economics & Human Biology* 2011;9(3):221-33. doi: 10.1016/j.ehb.2011.02.004.  
49  
50 43. Vassallo AJ, Kelly B, Zhang L, Wang Z, Young S, Freeman B. Junk Food Marketing  
51 on Instagram: Content Analysis. *JMIR Public Health Surveill* 2018;4(2):e54. doi:  
52 10.2196/publichealth.9594.  
53  
54 44. Freeman B, Kelly B, Baur L, Chapman K, Chapman S, Gill T, King L. Digital Junk: Food  
55 and Beverage Marketing on Facebook. *AmJPublic Health* 2014;104(12):e56-e64.  
56 doi: 10.2105/AJPH.2014.302167.  
57  
58 45. Harris JL, Fleming-Milici, F., Phaneuf, L., Jensen, M., Choi, Y. Y., McCann, M.,  
59 Mancini, S. Fast food advertising : Billions in spending, continued high exposure by  
60 youth. Rudd Center for Food Policy and Obesity 2021.

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46. Tatlow-Golden M, Parker D. The Devil is in the Detail: Challenging the UK Department of Health's 2019 Impact Assessment of the Extent of Online Marketing of Unhealthy Foods to Children. *Int J Environ Res Public Health* 2020;17(19). doi: 10.3390/ijerph17197231.
47. House of Commons Library. Advertising to children. 2021.
48. Boyland EJ, Harrold JA, Kirkham TC, Halford JCG. The extent of food advertising to children on UK television in 2008. *International Journal of Pediatric Obesity* 2011;6(5-6):455-61. doi: 10.3109/17477166.2011.608801.
49. Adams J, Tyrrell R, Adamson AJ, White M. Effect of Restrictions on Television Food Advertising to Children on Exposure to Advertisements for 'Less Healthy' Foods: Repeat Cross-Sectional Study. *PLoS ONE* 2012;7(2):e31578. doi: 10.1371/journal.pone.0031578.
50. Council of Better Business Bureaus. The Children's Food and Beverage Advertising Initiative in Action : A Report on Compliance and Progress During 2016. 2017.
51. Harris JL, Kalnova SS. Food and beverage TV advertising to young children: Measuring exposure and potential impact. *Appetite* 2018;123:49-55. doi: 10.1016/j.appet.2017.11.110.
52. Fleming-Milici F, Harris JL. Food marketing to children in the United States: Can industry voluntarily do the right thing for children's health? *Physiol Behav* 2020;227:113139. doi: 10.1016/j.physbeh.2020.113139.
53. Department of Health and Social Care and Department for Digital C, Media and Sport,. Introducing a total online advertising restriction for products high in fat, sugar and salt (HFSS). 2021.
54. Mytton OT, Boyland E, Adams J, Collins B, O'Connell M, Russell SJ, Smith K, Stroud R, Viner RM, Cobiac LJ. The potential health impact of restricting less-healthy food and beverage advertising on UK television between 05.30 and 21.00 hours: A modelling study. *PLoS medicine* 2020;17(10):e1003212.
55. Adams J, Tyrrell R, Adamson AJ, White M. Socio-economic differences in exposure to television food advertisements in the UK: a cross-sectional study of advertisements broadcast in one television region. *Public Health Nutr* 2012;15(3):487-94.
56. Brownell KD, Schwartz MB, Puhl RM, Henderson KE, Harris JL. The need for bold action to prevent adolescent obesity. *J Adolesc Health* 2009;45(3 Suppl):S8-17. doi: 10.1016/j.jadohealth.2009.03.004.
57. Montgomery KC, Chester J. Interactive food and beverage marketing: targeting adolescents in the digital age. *J Adolesc Health* 2009;45(3 Suppl):S18-29. doi: 10.1016/j.jadohealth.2009.04.006.
58. Harris JL, Brownell KD, Bargh JA. The Food Marketing Defense Model: Integrating Psychological Research to Protect Youth and Inform Public Policy. *Soc Issues Policy Rev* 2009;3(1):211-71. doi: 10.1111/j.1751-2409.2009.01015.x.
59. Harris JL, Yokum S, Fleming-Milici F. Hooked on Junk: Emerging Evidence on How Food Marketing Affects Adolescents' Diets and Long-Term Health. *Current Addiction Reports* 2021;8(1):19-27. doi: 10.1007/s40429-020-00346-4.

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59  
60
60. Forde H, White M, Levy L, Greaves F, Hammond D, Vanderlee L, Sharp S, Adams J. The Relationship between Self-Reported Exposure to Sugar-Sweetened Beverage Promotions and Intake: Cross-Sectional Analysis of the 2017 International Food Policy Study. *Nutrients* 2019;11(12). doi: 10.3390/nu11123047.
  61. Vanderlee L, Czoli CD, Pauzé E, Potvin Kent M, White CM, Hammond D. A comparison of self-reported exposure to fast food and sugary drinks marketing among parents of children across five countries. *Prev Med* 2021;147:106521. doi: 10.1016/j.ypmed.2021.106521.
  62. Tatlow-Golden M, Jewell J, Zhiteneva O, Wickramasinghe K, Breda J, Boyland E. Rising to the challenge: Introducing protocols to monitor food marketing to children from the World Health Organization Regional Office for Europe. *Obesity Reviews* 2021. doi: 10.1111/obr.13212.
  63. Tatlow-Golden M, Garde A. Digital food marketing to children: Exploitation, surveillance and rights violations. *Global Food Security* 2020;27:100423.
  64. World Cancer Research Fund International. How digital media markets unhealthy foods to children. 2017.
  65. Snap Inc. Internet: <https://www.snap.com/en-US/terms> (accessed 3 October 2021).
  66. Instagram. Internet: <https://help.instagram.com/581066165581870#> (accessed 3 October 2021).
  67. Facebook. Internet: <https://www.facebook.com/help/157793540954833/> (accessed October 3 2021).
  68. Ofcom. Children and Parents: Media Use and Attitudes Report. 2017.
  69. Gerritsen S, Sing F, Lin K, Martino F, Backholer K, Culpin A, Mackay S. The Timing, Nature and Extent of Social Media Marketing by Unhealthy Food and Drinks Brands During the COVID-19 Pandemic in New Zealand. *Front Nutr* 2021;8:645349. doi: 10.3389/fnut.2021.645349.

## TABLES

**Table 1.** Sample characteristics of adolescents in six countries (weighted) N = 9171.

Characteristic	All countries (n=9171)	Australia (n=1127)	Canada (n=2869)	Chile (n=1124)	Mexico (n=1505)	UK (n=1140)	USA (n=1406)
	% (n)						
<b>Age (years)</b>							
10-13	50 (4551)	51 (574)	50 (1438)	47 (534)	50 (750)	49 (562)	49 (693)
14-17	50 (4620)	49 (553)	50 (1431)	53 (590)	50 (755)	51 (578)	51 (713)
<b>Sex</b>							
Male	51 (4664)	52 (582)	50 (1446)	51 (572)	51 (761)	51 (581)	51 (722)
Female	49 (4507)	48 (545)	50 (1423)	49 (552)	49 (744)	49 (559)	49 (684)
<b>Ethnicity</b>							
Majority group	76 (6976)	75 (850)	73 (2098)	85 (958)	78 (1170)	83 (941)	68 (959)
Minority group	24 (2195)	25 (277)	27 (771)	15 (166)	22 (335)	17 (199)	32 (447)
<b>School grades</b>							
Low	16 (1461)	32 (365)	13 (373)	6 (65)	7 (101)	29 (334)	16 (223)
Mid	38 (3508)	38 (430)	34 (974)	49 (555)	36 (549)	38 (430)	41 (570)
High	46 (4202)	29 (332)	53 (1522)	45 (505)	57 (855)	33 (375)	44 (613)
<b>Perceived Income Adequacy</b>							
Inadequate	24 (2222)	25 (283)	17 (488)	31 (345)	28 (418)	26 (291)	28 (397)
Adequate	76 (6949)	75 (844)	83 (2381)	69 (779)	72 (1087)	74 (849)	72 (1009)
<b>Self-reported BMI</b>							
Severe thinness/thinness/normal weight	49 (4480)	45 (509)	57 (1630)	43 (478)	48 (717)	41 (462)	49 (683)
Overweight	18 (1665)	16 (176)	16 (473)	21 (231)	22 (334)	13 (147)	22 (304)
Obesity	10 (927)	10 (113)	9 (255)	9 (97)	10 (148)	8 (92)	16 (222)
Not reported	23 (2100)	29 (328)	18 (511)	28 (319)	20 (306)	39 (439)	14 (197)

**Table 2.** Estimates from a linear regression model examining the amount of self-reported exposure to screen-based media (in minutes) on a weekday among adolescents in six countries (n=9171).

Parameter	Weekday screen time	
	Wald $\chi^2$	B (CI)
<b>Country</b>	64.2	
AUS vs. CAN		-18.1 (-47.2,11.0)
AUS vs. CHILE		-170.2 (-205.8,-134.5)
AUS vs. MEX		-144.3 (-179.3,-109.3)
AUS vs. UK		-26.8 (-60.7,7.2)
AUS vs. USA		-107.8 (-142.6,-72.9)
CAN vs. CHILE		-152.1 (-181.9,-122.3)
CAN vs. MEX		-126.2 (-154.9,-97.5)
CAN vs. UK		-8.7 (-37.7,20.3)
CAN vs. USA		-89.7 (-118.2,-61.1)
CHILE vs. MEX		25.8 (-9.1,60.8)
CHILE vs. UK		143.4 (107.9,178.9)
CHILE vs. USA		62.4 (26.7,98.0)
MEX vs. UK		117.6 (82.7,152.4)
MEX vs. USA		36.5 (1.9,71.2)
UK vs. USA		-81.0 (-116.1,-45.9)
<b>Sex</b>	25.3	
Female vs. male		-34.7 (-52.4,-16.9)
<b>Age</b>	209.4	
10-13 years vs. 14-17 years		-99.7 (-117.4,-81.9)
<b>Ethnicity</b>	18.5	
Majority vs. minority		-38.9 (-62.2,-15.6)
<b>Perceived income adequacy</b>	16.0	
Adequate vs. inadequate		-33.0 (-54.3,-11.8)
<b>School grades</b>	19.9	
High vs. low		-64.0 (-90.7,-37.2)
High vs. mid		-26.6 (-46.2,-7.0)
Low vs. mid		37.4 (10.6,64.1)
<b>BMI</b>	16.9	
Not reported vs. Obesity		-67.5 (-102.2,-32.8)
Not reported vs. Overweight		-28.8 (-57.2,-0.3)
Not reported vs. Severe thinness/thinness/normal weight		12.4 (-10.3,35.1)
Obesity vs. Overweight		38.7 (2.5,74.9)
Obesity vs. Severe thinness/thinness/normal weight		79.9 (47.8,112.0)
Overweight vs. Severe thinness/thinness/normal weight		41.2 (16.4,65.9)

\* : Indicates significant Wald  $\chi^2$  test.

**Notes:** The variable listed second is the reference variable.

**Abbreviations:** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; B=Beta; CI = 99% confidence interval.

**Table 3.** Estimates from separate logistic regression models examining self-reported exposure to social media platforms among adolescents in six countries (n=9171).

Parameter	Exposure to Facebook		Exposure to Instagram		Exposure to TikTok		Exposure to Twitter		Exposure to Snapchat		No exposure to social media	
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
Country	81.7		17.6		15.2		28.4		43.3		10.0	
AUS vs. CAN		1.28 (1.04,1.56)		0.90 (0.73,1.11)		0.80 (0.64,1.00)		0.92 (0.70,1.20)		0.77 (0.63,0.95)		1.29 (1.01,1.66)
AUS vs. CHILE		0.81 (0.63,1.04)		0.48 (0.37,0.62)		1.41 (1.07,1.86)		0.72 (0.52,0.99)		1.96 (1.50,2.56)		1.72 (1.25,2.36)
AUS vs. MEX		0.23 (0.18,0.30)		0.95 (0.74,1.21)		1.54 (1.15,2.04)		0.37 (0.28,0.50)		1.57 (1.22,2.03)		2.18 (1.57,3.03)
AUS vs. UK		0.89 (0.70,1.14)		0.82 (0.64,1.05)		1.05 (0.80,1.36)		0.54 (0.40,0.73)		0.62 (0.48,0.79)		1.59 (1.16,2.18)
AUS vs. USA		0.84 (0.66,1.06)		1.06 (0.83,1.35)		0.85 (0.66,1.09)		0.60 (0.44,0.81)		0.73 (0.57,0.92)		1.19 (0.89,1.60)
CAN vs. CHILE		0.64 (0.51,0.79)		0.53 (0.43,0.66)		1.76 (1.40,2.22)		0.78 (0.61,1.01)		2.53 (2.02,3.18)		1.33 (1.01,1.75)
CAN vs. MEX		0.18 (0.14,0.22)		1.05 (0.86,1.28)		1.92 (1.51,2.44)		0.41 (0.33,0.51)		2.03 (1.64,2.50)		1.69 (1.27,2.25)
CAN vs. UK		0.70 (0.56,0.87)		0.91 (0.73,1.12)		1.31 (1.04,1.64)		0.59 (0.46,0.76)		0.80 (0.65,0.98)		1.23 (0.93,1.63)
CAN vs. USA		0.66 (0.54,0.80)		1.17 (0.96,1.42)		1.06 (0.87,1.30)		0.65 (0.52,0.82)		0.94 (0.78,1.13)		0.92 (0.72,1.18)
CHILE vs. MEX		0.28 (0.22,0.37)		1.96 (1.54,2.51)		1.09 (0.82,1.46)		0.52 (0.40,0.68)		0.80 (0.61,1.05)		1.27 (0.91,1.78)
CHILE vs. UK		1.10 (0.85,1.42)		1.70 (1.32,2.19)		0.74 (0.56,0.98)		0.75 (0.56,1.01)		0.31 (0.24,0.41)		0.92 (0.66,1.30)
CHILE vs. USA		1.04 (0.81,1.32)		2.19 (1.71,2.80)		0.60 (0.46,0.79)		0.83 (0.63,1.10)		0.37 (0.29,0.48)		0.69 (0.51,0.95)
MEX vs. UK		3.91 (2.99,5.10)		0.86 (0.67,1.11)		0.68 (0.51,0.91)		1.46 (1.11,1.90)		0.39 (0.30,0.51)		0.73 (0.51,1.03)
MEX vs. USA		3.68 (2.86,4.73)		1.11 (0.88,1.42)		0.55 (0.42,0.73)		1.61 (1.25,2.07)		0.46 (0.36,0.59)		0.55 (0.40,0.75)
UK vs. USA		0.94 (0.74,1.20)		1.29 (1.01,1.66)		0.81 (0.63,1.05)		1.11 (0.83,1.46)		1.18 (0.93,1.50)		0.75 (0.54,1.04)
Sex	0.6		69.7		250.4		1.9		163.6		85.3	
Female vs. male		1.04 (0.92,1.18)		1.50 (1.33,1.71)		2.31 (2.02,2.65)		0.92 (0.80,1.07)		1.87 (1.65,2.12)		0.55 (0.47,0.65)
Age	601.2		705.2		30.1		380.7		406.4		588.0	
10-13 years vs. 14-17 years		0.30 (0.26,0.34)		0.27 (0.24,0.30)		1.34 (1.17,1.54)		0.31 (0.27,0.36)		0.37 (0.32,0.42)		6.24 (5.14,7.58)
Ethnicity	0.4		1.5		0.0		2.3		0.2		1.1	
Majority vs. minority		0.96 (0.82,1.13)		0.93 (0.79,1.09)		1.01 (0.85,1.20)		0.90 (0.74,1.08)		0.97 (0.83,1.14)		1.09 (0.88,1.34)
Perceived income adequacy	6.1		2.6		1.3		7.6		0.4		0.1	
Adequate vs. inadequate		0.87 (0.75,1.01)		1.10 (0.95,1.27)		0.93 (0.80,1.09)		1.20 (1.01,1.43)		0.96 (0.83,1.12)		1.02 (0.84,1.23)
School grades	11.1		2.3		10.2		2.1		7.3*		12.3	
High vs. low		0.80 (0.66,0.97)		0.98 (0.81,1.18)		0.73 (0.60,0.89)		1.20 (0.95,1.51)		0.83 (0.69,1.00)		1.42 (1.11,1.82)
High vs. mid		0.78 (0.68,0.90)		0.89 (0.78,1.03)		0.82 (0.71,0.96)		1.03 (0.88,1.21)		0.82 (0.72,0.95)		1.35 (1.13,1.61)
Low vs. mid		0.98 (0.81,1.18)		0.92 (0.76,1.11)		1.13 (0.93,1.38)		0.86 (0.68,1.08)		0.99 (0.82,1.19)		0.95 (0.74,1.22)
BMI	12.1		7.8		3.0		4.1		10.8		12.8	
Not reported vs. Obesity		0.64 (0.50,0.81)		0.74 (0.58,0.94)		0.78 (0.61,1.00)		0.77 (0.58,1.02)		0.71 (0.56,0.90)		1.86 (1.38,2.52)
Not reported vs. Overweight		0.72 (0.59,0.89)		0.74 (0.61,0.90)		0.85 (0.69,1.05)		0.78 (0.61,0.98)		0.69 (0.56,0.84)		1.59 (1.24,2.04)
Not reported vs. Severe thinness/thinness/normal weight		0.93 (0.79,1.10)		0.76 (0.65,0.90)		0.95 (0.80,1.13)		0.94 (0.77,1.15)		0.72 (0.61,0.85)		1.32 (1.09,1.62)
Obesity vs. Overweight		1.13 (0.88,1.45)		1.00 (0.78,1.28)		1.09 (0.84,1.41)		1.02 (0.77,1.35)		0.97 (0.76,1.24)		0.85 (0.62,1.18)
Obesity vs. Severe thinness/thinness/normal weight		1.46 (1.17,1.82)		1.03 (0.83,1.29)		1.22 (0.97,1.53)		1.23 (0.96,1.59)		1.02 (0.82,1.26)		0.71 (0.53,0.95)
Overweight vs. Severe thinness/thinness/normal weight		1.28 (1.08,1.53)		1.03 (0.87,1.23)		1.12 (0.93,1.34)		1.21 (1.00,1.48)		1.05 (0.88,1.24)		0.83 (0.66,1.05)

**Notes :** The variable listed second is the reference variable.

**Abbreviations :** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

**Table 4.** Estimates from separate logistic regression models examining daily self-reported exposure to sugary beverage and fast food advertisements among adolescents in six countries on a weekday (n=9171).

Parameter	Daily exposure to sugary drinks ads		Daily exposure to fast food ads	
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
<b>Country</b>	70.4*		24.3*	
AUS vs. CAN		0.89 (0.69,1.15)		0.89 (0.72,1.10)
AUS vs. CHILE		0.37 (0.28,0.49)		1.11 (0.86,1.43)
AUS vs. MEX		0.29 (0.22,0.38)		0.90 (0.70,1.15)
AUS vs. UK		1.77 (1.26,2.50)		2.00 (1.52,2.62)
AUS vs. USA		0.62 (0.47,0.81)		0.67 (0.52,0.84)
CAN vs. CHILE		0.41 (0.33,0.52)		1.24 (1.00,1.54)
CAN vs. MEX		0.33 (0.27,0.41)		1.00 (0.82,1.23)
CAN vs. UK		1.99 (1.47,2.70)		2.24 (1.76,2.84)
CAN vs. USA		0.69 (0.56,0.86)		0.75 (0.62,0.90)
CHILE vs. MEX		0.79 (0.62,1.00)		0.81 (0.63,1.03)
CHILE vs. UK		4.80 (3.46,6.67)		1.80 (1.36,2.39)
CHILE vs. USA		1.67 (1.30,2.14)		0.60 (0.47,0.76)
MEX vs. UK		6.07 (4.39,8.39)		2.23 (1.69,2.94)
MEX vs. USA		2.11 (1.66,2.68)		0.74 (0.59,0.94)
UK vs. USA		0.35 (0.25,0.48)		0.33 (0.26,0.43)
<b>Sex</b>	1.5		0.4	
Female vs. male		1.07 (0.93,1.23)		1.03 (0.91,1.17)
<b>Age</b>	0.0		1.2	
10-13 years vs. 14-17 years		1.00 (0.86,1.16)		0.95 (0.83,1.08)
<b>Ethnicity</b>	0.1		0.0	
Majority vs. minority		1.02 (0.85,1.23)		1.00 (0.85,1.18)
<b>Perceived income adequacy</b>	1.0		4.5	
Adequate vs. inadequate		0.94 (0.80,1.11)		0.88 (0.76,1.03)
<b>School grades</b>	0.4		3.2	
High vs. low		0.93 (0.75,1.17)		0.95 (0.79,1.15)
High vs. mid		0.96 (0.82,1.13)		0.87 (0.76,1.00)
Low vs. mid		1.03 (0.83,1.29)		0.92 (0.76,1.11)
<b>BMI</b>	6.3*		6.4*	
Not reported vs. Obesity		0.73 (0.56,0.95)		0.75 (0.59,0.94)
Not reported vs. Overweight		0.70 (0.56,0.88)		0.75 (0.61,0.92)
Not reported vs. Severe thinness/thinness/normal weight		0.79 (0.66,0.96)		0.78 (0.66,0.93)
Obesity vs. Overweight		0.96 (0.74,1.25)		1.01 (0.79,1.28)
Obesity vs. Severe thinness/thinness/normal weight		1.09 (0.86,1.38)		1.05 (0.85,1.30)
Overweight vs. Severe thinness/thinness/normal weight		1.14 (0.94,1.38)		1.04 (0.88,1.24)
<b>Exposure to screen based media (weekday)</b>	88.2*	1.05 (1.04,1.07)	121.4*	1.05 (1.04,1.07)

\* Indicates significant Wald  $\chi^2$  test.

**Note :** The variable listed second is the reference variable. Exposure to screen based media is expressed in minutes.

**Abbreviations:** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

## FIGURES

**Figure 1.** Mean hours of total self-reported screen time (including YouTube, social media, television, playing games and browsing) on a weekday among adolescents in six countries after winsorization (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**Figure 2.** Percentage of adolescents in six countries self-reporting using platforms of social media (Facebook; Instagram; TikTok; Twitter; Snapchat; None) (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

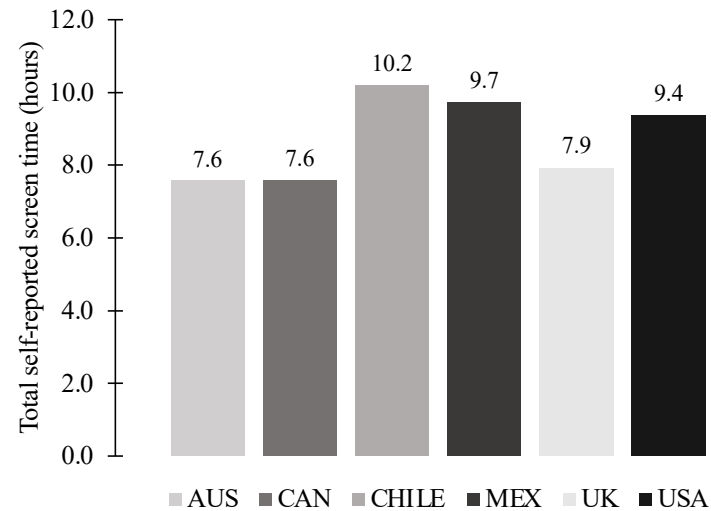
**Figure 3.** Percentage of adolescents in six countries self-reporting exposure to advertisements for unhealthy foods or drinks in three locations (TV shows, series or movies; Website or social media ; Video or computer games; None) in the last 30 days (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**Figure 4.** Percentage of adolescents in six countries self-reporting daily exposure to advertisements for sugary drinks and fast food in the last 30 days (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

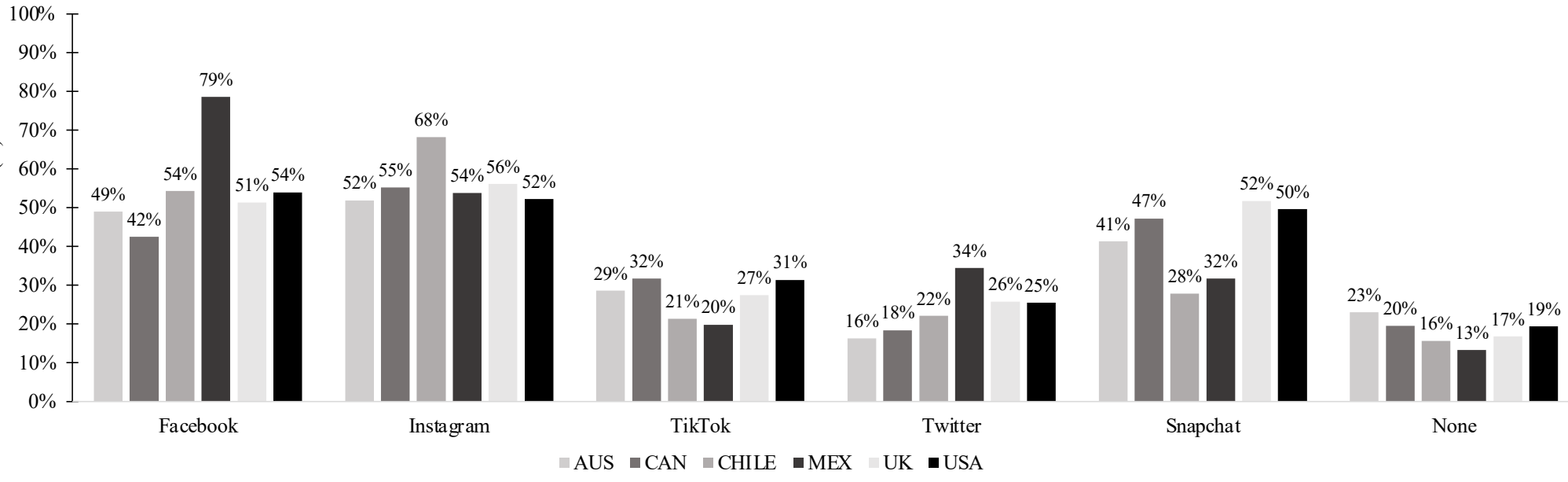




**Figure 1.** Mean hours of total self-reported screen time (including YouTube, social media, television, playing games and browsing) on a weekday among adolescents in six countries after winsorization (n=9171).

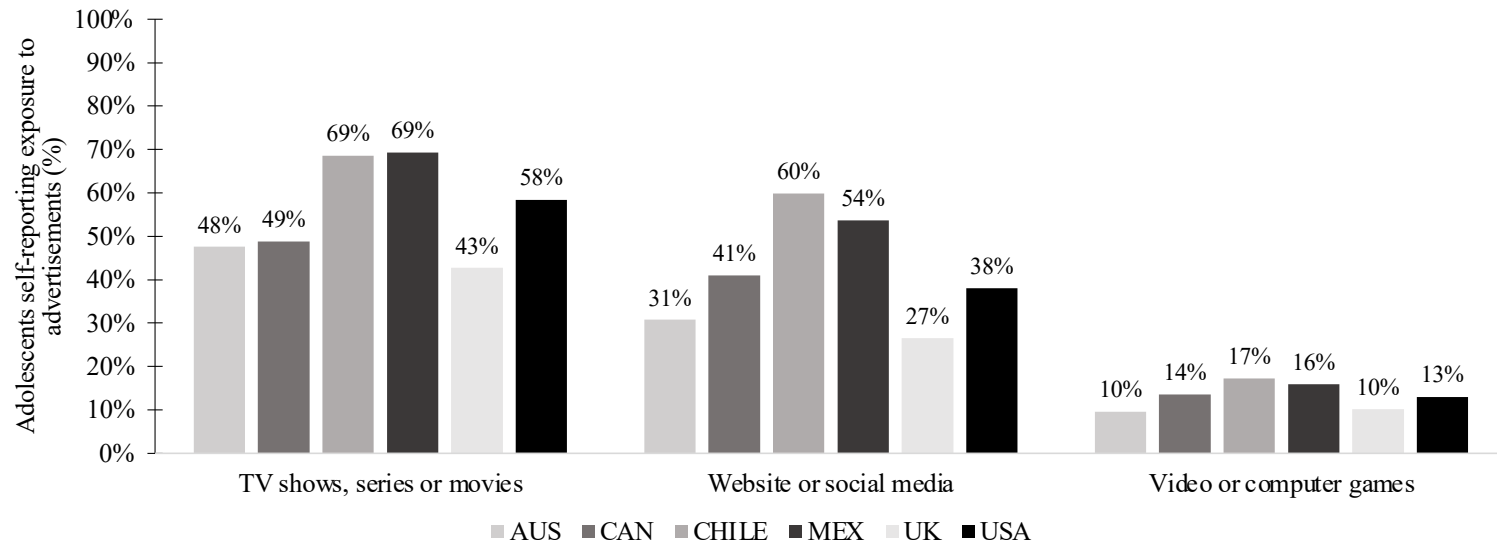
Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

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**Figure 2.** Percentage of adolescents in six countries self-reporting using platforms of social media (Facebook; Instagram; TikToc; Twitter; Snapchat; None) (n=9171).

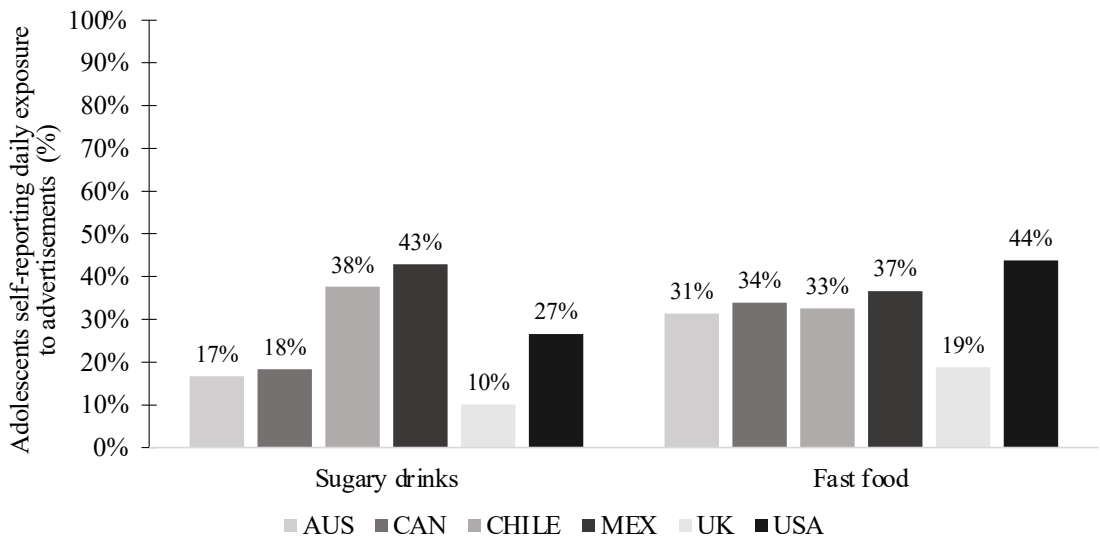
Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.



**Figure 3.** Percentage of adolescents in six countries self-reporting exposure to advertisements for unhealthy foods or drinks in three locations (TV shows, series or movies; Website or social media ; Video or computer games; None) in the last 30 days (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

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**Figure 4.** Percentage of adolescents in six countries self-reporting daily exposure to advertisements for sugary drinks and fast food in the last 30 days (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

## SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.

Adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

**Supplementary Table S1.** Estimates from separate linear regression models examining the amount of self-reported exposure to screen-based media (in minutes) on a weekend day among adolescents in six countries (n=9171).

Parameter	Weekend day screen time	
	Wald $\chi^2$	B (CI)
<b>Country</b>	47.0*	
AUS vs. CAN		-6.8 (-35.7,22.0)
AUS vs. CHILE		-136.9 (-173.8,-100.0)
AUS vs. MEX		-130.0 (-165.4,-94.7)
AUS vs. UK		-26.7 (-60.8,7.4)
AUS vs. USA		-85.6 (-120.1,-51.1)
CAN vs. CHILE		-130.1 (-161.3,-98.8)
CAN vs. MEX		-123.2 (-152.1, -94.2)
CAN vs. UK		-19.8 (-48.7,9.0)
CAN vs. USA		-78.8 (-107.0,-50.6)
CHILE vs. MEX		6.9 (-29.7,43.5)
CHILE vs. UK		110.2 (73.4,147.1)
CHILE vs. USA		51.3 (14.5,88.1)
MEX vs. UK		103.3 (68.2,138.5)
MEX vs. USA		44.4 (9.6,79.2)
UK vs. USA		-58.9 (-93.8,-24.1)
<b>Sex</b>	15.0*	
Female vs. male		-27.0 (-44.9,-9.0)
<b>Age</b>	167.5*	
10-13 years vs. 14-17 years		-90.3 (-108.3,-72.4)
<b>Ethnicity</b>	13.0*	
Majority vs. minority		-32.9 (-56.3,-9.4)
<b>Perceived income adequacy</b>	32.0*	
Adequate vs. inadequate		-47.2 (-68.8,-25.7)
<b>School grades</b>	30.7*	
High vs. low		-79.7 (-106.7,-52.6)
High vs. mid		-35.8 (-55.6,-16.1)
Low vs. mid		43.8 (16.9,70.7)
<b>BMI</b>	10.7*	
Not reported vs. Obesity		-66.2 (-100.0,-32.4)
Not reported vs. Overweight		-20.6 (-48.6,7.4)
Not reported vs. Severe thinness/thinness/normal weight		-2.0 (-25.2,21.1)
Obesity vs. Overweight		45.6 (10.8,80.4)
Obesity vs. Severe thinness/thinness/normal weight		64.2 (32.9,95.5)
Overweight vs. Severe thinness/thinness/normal weight		18.6 (-5.9,43.0)

\* : Indicates significant Wald  $\chi^2$  test.

**Notes :** The variable listed second is the reference variable.

**Abbreviations :** AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; B=Beta; CI = 99% confidence interval.

## SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.

### Adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

**Supplementary Table S2.** Estimates from separate logistic regression models examining daily self-reported exposure to sugary beverage and fast food advertisements among adolescents in six countries on a weekend day (n=9171).

Parameter	Daily exposure to sugary drinks ads		Daily exposure to fast food ads	
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
<b>Country</b>	70.2*		24.8*	
AUS vs. CAN		0.88 (0.69,1.13)		0.88 (0.72,1.09)
AUS vs. CHILE		0.37 (0.28,0.49)		1.11 (0.86,1.44)
AUS vs. MEX		0.29 (0.22,0.39)		0.91 (0.71,1.17)
AUS vs. UK		1.78 (1.26,2.52)		2.02 (1.54,2.65)
AUS vs. USA		0.61 (0.47,0.81)		0.66 (0.52,0.84)
CAN vs. CHILE		0.42 (0.33,0.52)		1.26 (1.01,1.57)
CAN vs. MEX		0.33 (0.27,0.41)		1.03 (0.84,1.27)
CAN vs. UK		2.02 (1.49,2.75)		2.29 (1.80,2.90)
CAN vs. USA		0.70 (0.56,0.86)		0.75 (0.62,0.91)
CHILE vs. MEX		0.80 (0.63,1.02)		0.82 (0.64,1.05)
CHILE vs. UK		4.86 (3.50,6.76)		1.81 (1.37,2.40)
CHILE vs. USA		1.67 (1.30,2.15)		0.59 (0.47,0.76)
MEX vs. UK		6.08 (4.40,8.40)		2.22 (1.68,2.92)
MEX vs. USA		2.09 (1.64,2.66)		0.73 (0.58,0.92)
UK vs. USA		0.34 (0.25,0.48)		0.33 (0.25,0.43)
<b>Sex</b>	1.3		0.3	
Female vs. male		1.07 (0.92,1.23)		1.03 (0.91,1.17)
<b>Age</b>	0.0		0.7	
10-13 years vs. 14-17 years		1.01 (0.87,1.17)		0.96 (0.84,1.09)
<b>Ethnicity</b>	0.0		0.0	
Majority vs. minority		1.02 (0.85,1.23)		1.00 (0.85,1.18)
<b>Perceived income adequacy</b>	0.5		3.1	
Adequate vs. inadequate		0.95 (0.81,1.13)		0.90 (0.78,1.05)
<b>School grades</b>	0.1		2.7	
High vs. low		0.96 (0.77,1.20)		0.98 (0.81,1.19)
High vs. mid		0.98 (0.84,1.15)		0.89 (0.77,1.02)
Low vs. mid		1.02 (0.81,1.27)		0.90 (0.74,1.09)
<b>BMI</b>	6.3*		6.0*	
Not reported vs. Obesity		0.74 (0.57,0.96)		0.76 (0.60,0.96)
Not reported vs. Overweight		0.70 (0.56,0.87)		0.75 (0.61,0.92)
Not reported vs. Severe thinness/thinness/normal weight		0.81 (0.66,0.98)		0.79 (0.67,0.94)
Obesity vs. Overweight		0.94 (0.72,1.23)		0.99 (0.78,1.26)
Obesity vs. Severe thinness/thinness/normal weight		1.09 (0.86,1.38)		1.05 (0.85,1.30)
Overweight vs. Severe thinness/thinness/normal weight		1.16 (0.96,1.40)		1.06 (0.89,1.27)
<b>Exposure to screen based media (weekend day)</b>	128.7*	1.06 (1.05,1.08)	186.5*	1.07 (1.06,1.08)

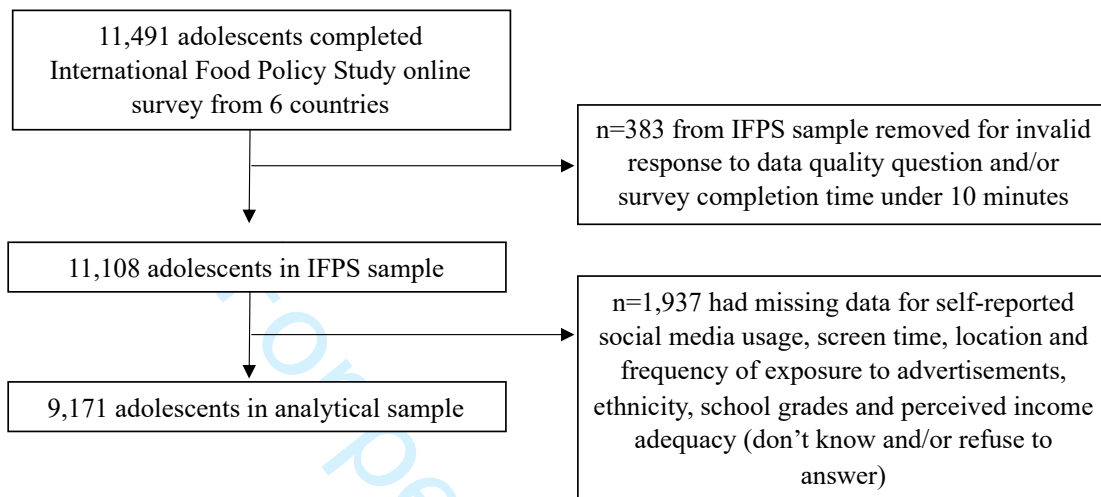
\* : Indicates significant Wald  $\chi^2$  test.

**Notes** : The variable listed second is the reference variable. Exposure to screen based media is expressed in minutes.

**Abbreviations** : AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

**SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.**

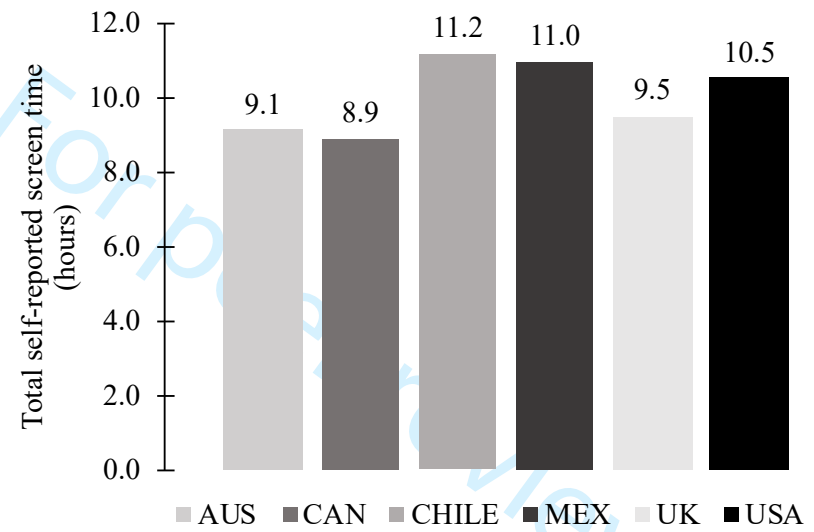
Adolescents' media usage and self-reported exposure to advertising across six countries:  
implications for less healthy food and beverage marketing



**Supplementary Figure S1.** Flow chart of participants included in the analytical sample.

**SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.**

Adolescents’ media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing



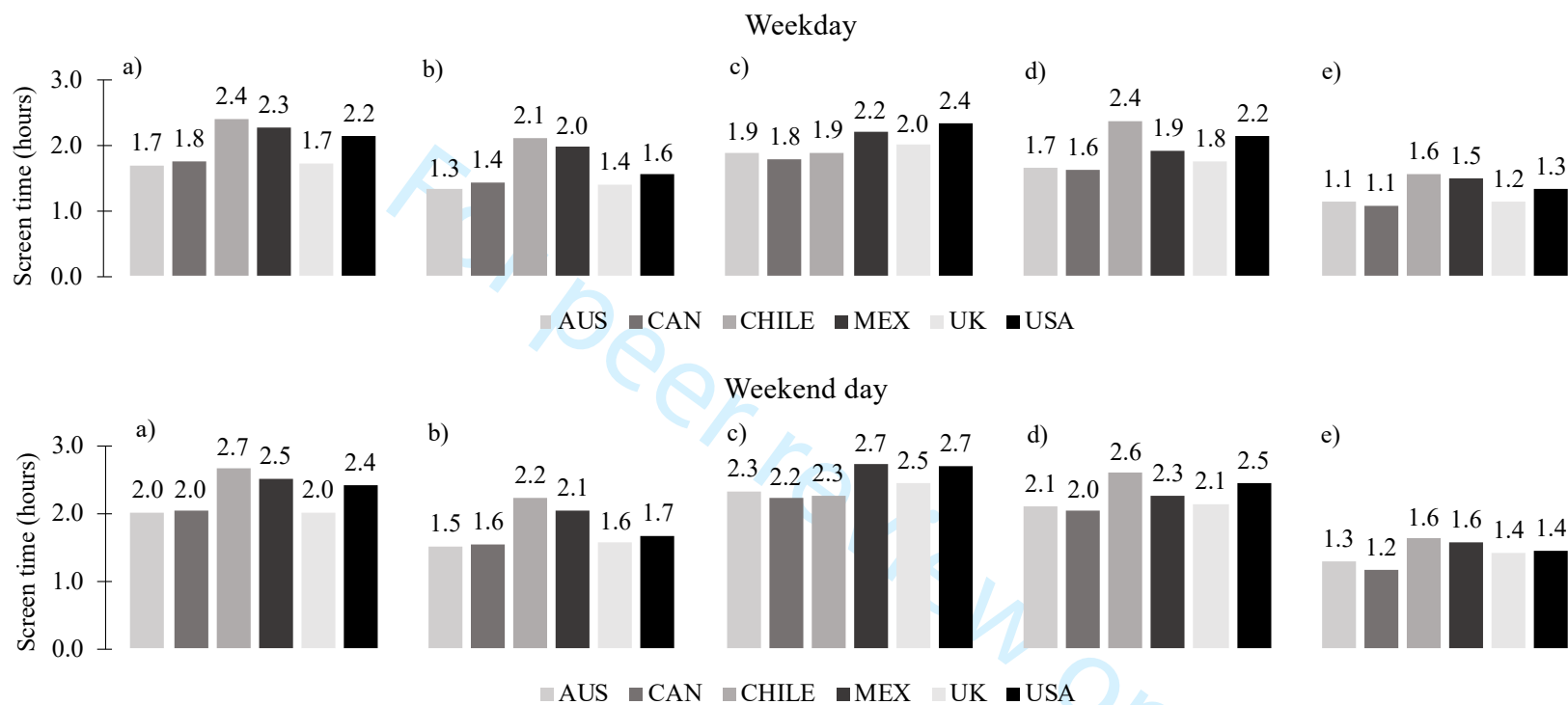
**Supplementary Figure S2.** Mean hours of total self-reported screen time (including YouTube, social media, television, playing games and browsing) on a weekend day among adolescents in six countries after winsorization (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.



**SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.**

Adolescents’ media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing



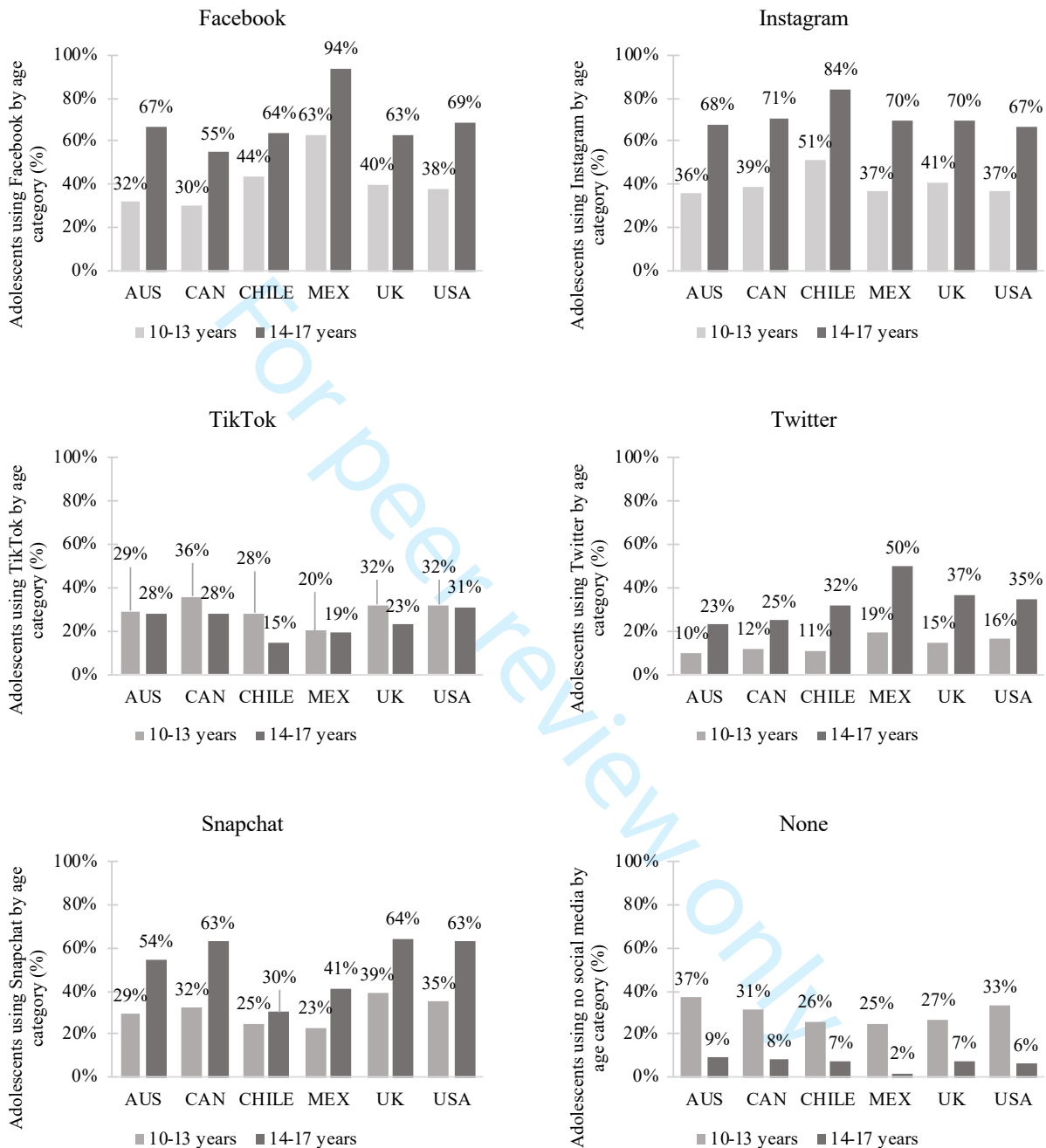
**Supplementary Figure S3.** Mean amount of self-reported screen time (in hours) for five media channels on a weekday (above) and weekend day (below) among adolescents in six countries before winsorization (n=9171).

- a) Watching YouTube
- b) On social media (including messaging, posting, or liking posts)
- c) Watching TV shows, series, or movies
- d) Playing games on smartphones, computers, or game consoles
- e) Browsing, reading websites, Googling, etc.

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

## SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.

### Adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

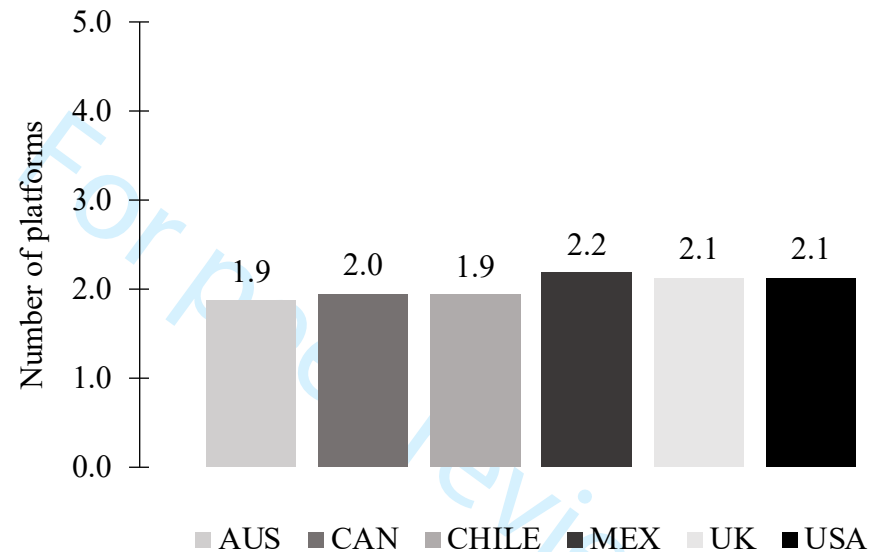


**Supplementary Figure S4.** Percentage of adolescents in six countries self-reporting using platforms of social media (Facebook; Instagram; TikTok; Twitter; Snapchat; None) by age category (n=9171).

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

**SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.**

Adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing



**Supplementary Figure S5.** Mean number of social media platforms self-reported being used among adolescents in six countries (n=9171) <sup>a</sup>.

Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.

<sup>a</sup> Range of 0 to 5 possible social media platforms.

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	3
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-11
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-11
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	12
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	12-13
		(b) Describe any methods used to examine subgroups and interactions	13
		(c) Explain how missing data were addressed	12
		(d) If applicable, describe analytical methods taking account of sampling strategy	13
		(e) Describe any sensitivity analyses	-
<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	12
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	12, SFig 1
Outcome data	15*	Report numbers of outcome events or summary measures	14-16
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Table 3

		(b) Report category boundaries when continuous variables were categorized	13
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	15
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	18
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	23-24
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	18-22
Generalisability	21	Discuss the generalisability (external validity) of the study results	24-25
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).