

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<u>http://bmjopen.bmj.com</u>).

If you have any questions on BMJ Open's open peer review process please email <u>info.bmjopen@bmj.com</u>

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

Journal:	BMJ Open
Manuscript ID	bmjopen-2021-058913
Article Type:	Original research
Date Submitted by the Author:	08-Nov-2021
Complete List of Authors:	Demers-Potvin, Élisabeth; Université Laval, École de nutrition, Centre de nutrition, santé et société (NUTRISS) White, Martin; University of Cambridge, Centre for Diet and Activity Research (CEDAR), MRC Epidemiology Unit Potvin Kent, Monique; University of Ottawa, School of Epidemiology and Public Health, Faculty of Medicine Nieto, Claudia; National Institute of Public Health, Center for Health and Nutrition Research White, Christine; University of Waterloo, School of Public Health Sciences, Faculty of Health Zheng, Xueying; St Helens and Knowsley Teaching Hospitals NHS Trust Hammond, D; University of Waterloo Vanderlee, Lana; Universite Laval, École de nutrition, Centre de nutrition, santé et société (NUTRISS)
Keywords:	Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, NUTRITION & DIETETICS, PUBLIC HEALTH

# SCHOLARONE<sup>™</sup> Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our <u>licence</u>.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which <u>Creative Commons</u> licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

terez oni

Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies



BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool .

rasmushogeschool

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

# Children's and adolescents' media usage and self-reported exposure to advertising

# across six countries: implications for less healthy food and beverage marketing

Élisabeth Demers-Potvin, Martin White, Monique Potvin Kent, Claudia Nieto, Christine

M. White, Xueying Zheng, David Hammond, Lana Vanderlee\*

École de Nutrition, Centre de nutrition, santé et société (NUTRISS), Université Laval, Québec, Québec G1V 0A6, Canada (ÉDP, LV)

UKCRC Centre for Diet and Activity Research (CEDAR), MRC Epidemiology Unit, University of Cambridge School of Clinical Medicine, Cambridge CB2 000, UK (MW) School of Epidemiology and Public Health, Faculty of Medicine, University of Ottawa, Ottawa, Ontario K1G 5Z3, Canada (MPK)

School of Public Health Sciences, Faculty of Health, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada (DH, CMW)

Center for Health and Nutrition Research, National Institute of Public Health, Cuernavaca, Morelos, Mexico (CN)

St Helens and Knowsley Teaching Hospitals NHS Trust, Rainhill, L35 5DR, UK (XZ)

# \*Corresponding author:

Lana Vanderlee, PhD 2440, boulevard Hochelaga, Québec, Québec (Canada), G1V 0A6 Telephone: 519-498-3555 Email: lana.vanderlee@fsaa.ulaval.ca

# Abbreviations

IFPS : International Food Policy Study

UK : United Kingdom

USA : United States of America

Word count: 5780

#### BMJ Open

1	ABSTRACT
2	<b>Objectives:</b> The study objectives were to examine: 1) children's and adolescent's media
3	viewing habits; 2) associations with media viewing and self-reported exposure to
4	unhealthy food and beverage advertising; and 3) differences in trends among population
5	subgroups (particularly between children and adolescents) in six high and upper-middle
6	income countries.
7	Design: Repeat cross-sectional online survey.
8	Setting: Australia, Canada, Chile, Mexico, the United Kingdom (UK) and the United
9	States (USA).
10	Participants: Respondents to the International Food Policy Study (IFPS) who provided
11	information on all variables of interest in November-December 2019 aged 10 to 17 years
12	(n=9171).
13	Outcome measures: Self-reported exposure to screen-based media (screen time by
14	media channel), use of social media platforms, and location and frequency of exposure to
15	unhealthy food and beverage advertising.
16	<b>Results:</b> The average amount of time spent in front of various screens ranged from 7.6
17	hours to 10.2 hours across countries per weekday. Overall, Instagram was the most
18	popular social media platform (52-68% by country), followed by Facebook (42-79%) and
19	Snapchat (28-52%). The percentage of respondents who reported having seen unhealthy
20	food 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 exposure to
22	advertising varied between countries for sugary drinks (10-43%) and fast food (19-44%),
23	and was positively associated with screen time. Exposure to screen-based media and

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

BMJ Open

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
33	
34	Article summary
35	Strenghts 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.
46 47	
ч,	

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

#### **BMJ** Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool .

rasmushogeschool

Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies

#### 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)

Page 6 of 47

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool

Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies

and gaming sites, all have different implications with regard to the exposure and power of
marketing messages that reach their audience.
Companies are increasingly using digital platforms as a complement to traditional
advertising on television in a mixed-media approach to maximize the reach, efficiency
and effectiveness of marketing (15, 16). Globally, time spent online on social media,
gaming, streaming, and browsing the web is significant, and appears to be increasing in

some countries (17-19), representing an important channel for advertising energy dense products (20-24). Given the shifting media consumption habits of children and adolescents, exploration of media consumption and associations with exposure to marketing of less healthy food products, and their patterning by demographic and socio-economic factors is warranted. Most studies to date that examine media consumption habits among children have been limited to a single media type, and do not examine exposure across multiple countries. This study aimed to explore children's and adolescent's media consumption habits (screen time and use of social media platforms) and associations with self-reported exposure to unhealthy food and beverage advertisements (location and frequency) across six high and upper-middle income countries (Australia, Canada, Chile, Mexico, UK and USA). As a secondary objective, the study aimed to examine differences in trends among population subgroups, and in particular differences in trends between children (10-13 years) and adolescents (14-17 years), the latter of which often fall outside the purview of policies restricting marketing of unhealthy food and beverages.

92 2. Subjects and methods

Page 7 of 47

1

#### BMJ Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2	
_ ז	
л Л	
-	
5 6 7 8 9 10	
0	
/	
8	
9	
10	
11	
12	
13	
14	
15	
15 16 17	
17	
18	
10	
17	
∠∪ ว1	
<ol> <li>19</li> <li>20</li> <li>21</li> <li>22</li> <li>23</li> <li>24</li> <li>25</li> <li>26</li> <li>27</li> <li>28</li> <li>29</li> <li>30</li> </ol>	
22	
23	
24	
25	
26	
27	
28	
29	
30	
21	
22	
33	
34 35	
25	
26	
36 37	
3/	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
52 53	
54	
55	
56	
57	
58	
59	
60	

93	Data are from the 2019 International Food Policy Study (IFPS) Youth Survey, an
94	annual repeat cross-sectional survey conducted in Australia, Canada, Chile, Mexico, the
95	UK and the USA. Data were collected via self-completed, web-based surveys conducted
96	in November-December 2019 with children and adolescents aged 10 to 17 years.
97	Respondents were recruited through parents/guardians enrolled in the Nielsen Consumer
98	Insights Global Panel and their partners' panels. Email invitations with unique survey
99	links were sent to adult panelists within each country. Those who confirmed they had a
100	child aged 10 to 17 living in their household were asked for permission for their child to
101	complete the survey (only one child per household was invited). Children aged 10 to 17
102	years were eligible to participate, with quotas for age and sex groups in the UK and USA.
103	After eligibility screening, all potential respondents were provided with information
104	about the study and asked to provide assent. Surveys were conducted in English in
105	Australia and the UK; Spanish in Chile and Mexico; English or French in Canada; and
106	English or Spanish in the USA. Members of the research team who were native in each
107	language reviewed the French and Spanish translations independently. The median
108	survey time was 24 minutes.
109	The child's parent/guardian received remuneration in accordance with their panel's
110	usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes).
111	A full description of the study methods can be found in the International Food Policy
112	Study: Technical Report – 2019 Youth Survey at
113	http://foodpolicystudy.com/methods/(25).
114	2.1 Total screen time and screen time by media channel and activity

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

1	
2 3	
3 4	
4 5	
6	
7	
, 8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23 24	
24 25	
25 26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39 40	
40 41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53 54	
54 55	
55 56	
57	
58	
59	
60	

1

115	Self-reported daily screen time was measured using the question: "On a normal
116	weekday, how much time do you spend?" Participants were asked to answer this
117	question for five different media channels and/or activities: YouTube, social media
118	(including messaging, posting, or liking posts); TV (shows, series, or movies); playing
119	games (on smartphones, computers, or game consoles); and browsing (reading websites,
120	Googling, etc.). Responses for amount of screen time for each media channel were
121	captured using a scale (none; up to 15 minutes; up to 30 minutes; up to 1 hour; up to 2
122	hours; up to 3 hours; up to 4 hours; more than 4 hours; don't know; refuse to answer).
123	The same question was presented afterwards for a "normal weekend day". Although the
124	phrasing "up to" means that participants could have watched less than the stated value,
125	the ceiling value was used to calculate an estimated amount of time in minutes spent on
126	each media channel and all channels combined. For example, up to 15 minutes was
127	recoded as 15 minutes, and up to 1 hour was recoded as 60 minutes. Those who
128	responded "more than 4 hours" were recoded as 300 minutes (i.e., 5 hours). As children
129	could have been viewing multiple media channels simultaneously, the sum of exposure
130	(i.e., total minutes across all media types) was used as an overall indicator of total amount
131	of exposure to screen-based media. Winsorization was used to limit the effect of extreme
132	values on total screen time (26). The maximum amount of total screen time was set at the
133	mean + 2 SD, in this case 1195 minutes for a weekday and 1268 minutes for a weekend
134	day. Participants (n=572, weekday (6.2%) and n=432, weekend day (4.7%)) who
135	exceeded this value had their total screen time decreased to the maximum. The
136	winsorization technique yielded a slightly higher cutoff (+73 minutes) for weekends, as
137	might be expected. The maximum amount obtained using this method was compared

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Page 9 of 47

#### BMJ Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

1	
2	
3 4	
4	
5	
6	
6 7	
8	
8 9	
10	
11	
12	
13	
14	
12 13 14 15	
16	
16 17	
18	
18 19	
20	
∠∪ ว1	
20 21 22 23	
22	
23	
24	
25	
26	
27	
29 29	
28	
29	
30	
31	
32	
33	
34	
35	
26	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
58 59	
60	

138	with a hypothetical estimation based on an assumption that on a weekday, children and
139	adolescents spend roughly 7 hours at school and 8 hours sleeping, which sums up to 15
140	hours. It is plausible that there may have been some screen time during school hours that
141	would fall within the aforementioned categories (browsing or watching YouTube), and so
142	it was assumed that this was approximately 1 hour. The total (14 hours) was subtracted
143	from the length of a day (24 hours) to give a possible maximum of 10 hours of screen
144	time, with a maximum of 20 hours if two screens were being used simultaneously. This
145	estimation of 20 hours (1200 minutes) confirms the measure of total maximal screen time
146	for weekdays (1195 minutes) and weekends (1268 minutes) has good face-validity.
147	2.2 Usage of social media platforms
148	Self-reported usage of various social media platforms was assessed using the
149	measure: "Do you use? (select all that apply)" (Response options: "Facebook",
150	"Instagram", "TikTok", "Twitter", "Snapchat", "none of the above", "don't know" or
151	"refuse to answer").
152	2.3 Location of exposure to unhealthy food and beverage advertisements
153	The location of exposure to advertisements was assessed using the question: "Have
154	you seen or heard <u>advertisements for "unhealthy" foods or drinks</u> in any of these places
155	in the last 30 days?" Participants were instructed "Unhealthy food and drinks include
156	processed foods high in sugar, salt, or saturated fat, such as soda/pop, fast food, chips,
157	sugary cereals, cookies and chocolate bars." Participants could select all the responses
158	that applied from a list of 13 potential media channels, and an 'other' option with an
159	open-text box, or "I haven't seen any ads for unhealthy food in the last 30 days", "don't
160	know" or "refuse to answer." In this study, three channels were analyzed that pertain to

screen-based media (television shows, series or movies; website or social media; and video or computer games). Open text data were reviewed, and responses were re-coded to be included as one of the categorical options as applicable. "YouTube" and "social media" were recoded to be included in the category "website or social media" and "TV" was re-coded in the category of television shows. When participants wrote "all" in the open text, these responses were coded in each category of marketing location. 2.4 Frequency of exposure to unhealthy food and beverage marketing The frequency of exposure to unhealthy food and beverage marketing was assessed using the question: "In the last 30 days, how often did you see or hear advertisements for these kinds of food or drinks?" Participants responded for advertisements for six food categories, two of which were included in this analysis (sugary drinks; fast food from a restaurant). The frequency was assessed using a likert-type scale. (Response options: "never", "less than once a week", "once a week", "a few times a week", "everyday", "more than once a day", "don't know" and "refuse to answer"). Frequency of exposure was then recoded as a binary variable, where "everyday" and "more than once a day" were combined as "daily", and the other options combined as "less than once a day"; responses of "don't know" or "refused" were considered as missing. 

**2.5 Socio-demographic measures** 

Socio-demographic data included age, ethnicity, sex, country, school grades and perceived income adequacy. Age was included as a binary variable, (children aged 10 to 13 years, and adolescents aged 14 to 17 years). Ethnicity was assessed using unique measures from each country and re-coded to derive comparable measures across countries: *majority* or *minority* ethnicity. Participant's sex was self-reported by asking

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Page 11 of 47

#### **BMJ** Open

2		
3 4	184	"Are you" with responses "male" or "female". School grades were measured using the
5 6 7	185	question: "What grades do you usually get in school?" Response options varied across
7 8 9	186	countries and were re-coded to derive comparable measures across countries and three
10 11	187	groups were created: "low" ( <grade "mid"="" (grade="" b="" countries),="" in="" most="" most<="" of="" td=""></grade>
12 13	188	countries) or "high" grades (grade of A in most countries). Perceived income adequacy
14 15	189	was examined using the measure: "Does your family have enough money to pay for
16 17 18	190	things your family needs?" (Response options: "not enough money", "barely enough
19 20	191	money", "enough money", "more than enough money", "don't know" and "refuse to
21 22	192	answer"). Perceived income adequacy was recoded as a binary variable, (not enough
23 24 25	193	money/barely enough money were combined as "inadequate" and enough money/more
25 26 27	194	than enough money were combined as "adequate"); responses of "don't know" or
28 29	195	"refused" were considered as missing and excluded from analyses. Participant's body
30 31	196	mass index (BMI) was calculated using self-reported height and weight. BMI was
32 33 34	197	assessed using z-scores and classified according to the WHO recommendations (27).
35 36	198	Severe thinness, thinness and normal weight were combined considering low levels of
37 38	199	respondents for the severe thinness and thinness category (All countries = 2.9%,
39 40 41	200	Australia = 3.3%, Canada = 4.2%, Chile = 0.9%, Mexico = 1.7%, UK = 2.8%, US =
42 43	201	3.0%). Extreme values were recoded as missing (z-score $< -5$ or $> 5$ ) according to the
44 45	202	WHO growth reference guidelines (28). Extreme values as well as those participants
46 47	203	whose height and/or weight were missing were coded as "not reported" and included in
48 49 50	204	the analytic sample to reduce bias as potentially important differences between those who
51 52	205	do not report their height and weight in population-level surveys have been identified
53 54		

(29). A full list of measures in each country is available at http://foodpolicystudy.com/methods/ in the surveys section (30). 2.6 Data analysis A total of 11,491 children and adolescents completed the survey. Respondents were excluded for the following reasons: region was missing, ineligible or had an inadequate sample size (i.e., Canadian territories); invalid response to a data quality question; and/or survey completion time under 10 minutes (n=383). The analytic sample included 11,108 respondents (Australia: n=1,435; Canada: n=3,682; Chile: n=1,252; Mexico: n=1,616; UK: n=1,520; USA: n=1,603). A sub-sample (N=9,171) was included in the current analysis after excluding respondents with missing data (including don't know and refuse to answer) for social media usage, screen time, location and frequency of exposure to unhealthy food and beverage marketing, ethnicity, school grades and perceived income adequacy (Supplementary Figure S1). Data were weighted with post-stratification sample weights constructed using a raking algorithm with population estimates from the census in each country based on age group, sex, region, and ethnicity (except in Canada). Reported estimates are weighted. Descriptive statistics were tabulated including the mean number of hours viewing screen-based media across all channels and by channel on a weekday and weekend day, the usage of each social media platform and mean number of social media platforms (maximum of 5 platforms), the frequency of the three advertisement locations and the percentage of respondents being exposed daily to advertisements for sugary drinks and fast food by country. 

Page 13 of 47

#### **BMJ** Open

2		
- 3 4	228	Regression models examined differences in the amount of exposure to screen-based
5 6	229	media between countries and population subgroups. First, linear regressions were
7 8	230	conducted with the amount of exposure to screen-based media (total screen time in
9 10 11	231	minutes) as the dependent variable, including an indicator variable for country and
12 13	232	variables for sex, age category (10-13 years, 14-17 years), ethnicity, perceived income
14 15	233	adequacy, school grades, and BMI. Next, separate logistic regression models were
16 17	234	conducted for each social media type (1=yes, 0=no), including an indicator variable for
18 19 20	235	country and including the same list of correlates. Lastly, separate logistic regression
21 22	236	analyses were used to examine associations between the exposure to screen-based media
23 24	237	and daily frequency of self-reported exposure to advertisements for each of the food
25 26 27	238	categories (sugary drinks; fast food from a restaurant), with daily exposure to sugary
27 28 29	239	drink or fast food marketing as the dependent variable, including indicator variables for
30 31	240	the amount of exposure on a weekday (continuous) and country, adjusting for the same
32 33	241	demographic correlates. Separate models were tested for exposure to screen-based media
34 35 26	242	on weekends. For all regressions, survey-aware procedures were used to account for
36 37 38	243	finite sampling methods, and 99% confidence intervals are presented due to the use of
39 40	244	multiple comparisons. Analyses were conducted using SAS v. 14.
41 42	245	2.7 Patient and public involvement
43 44		-
45	246	Patients and the public were not involved in the design, conduct, analysis or

interpretation of the study. Study participants could have access to the study results upon request.

3. Results

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2	
3	
4	
5	
6	
7	
-	
8	
9	
10	
11	
12	
12	
13	
14	
12 13 14 15 16	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
55 54	
55	
56	
57	
58	
59	
60	
~~	

Weighted sample characteristics are presented in **Table 1**. There were differences between countries in ethnicity group, school grades, perceived income adequacy and BMI. In general, a greater percentage of participants identified as a minority group in the USA, a smaller percentage had high school grades in Australia and the UK, and a greater percentage perceived their family income as adequate in Canada.

255

1

h

### 3.1 Exposure to screen-based media

256 Figure 1 shows the mean amount of total screen time for a weekday among 257 participants across countries, which ranged from 7.6 hours (Canada and Australia) to 10.2 258 hours (Chile). Similar findings were observed across countries for a weekend day, but 259 with higher total amounts (Supplementary Figure S2), which ranged from 8.9 hours 260 (Canada) to 11.2 hours (Chile). Time spent on various media channels is shown in 261 Supplementary Figure S3. Digital media, comprised of YouTube, social media and 262 browsing, reading websites and Googling, was the largest contributor overall, and 263 comprised 4.8 hours (weekday) and 5.4 hours (weekend day) on average. Browsing, 264 reading websites and Googling accounted for the least amount of screen time on a 265 weekday and weekend day in all countries. Across all countries, participants in Chile 266 spent the highest amount of time on YouTube, social media, playing games and 267 browsing, while participants in the USA spent the most time watching television on a 268 weekday.

Estimates from a linear regression model examining the total amount of exposure to screen-based media on a weekday across countries is shown in **Table 2**. Total screen time differed by country, and across all demographic correlates. Participants in Canada and Australia reported less screen time than those in Chile, Mexico and USA; and Chilean

#### **BMJ** Open

1 2		
3 4	273	participants reported more screen time than those in all other countries except Mexico.
5 6	274	Female participants self-reported less screen time than their male counterparts;
7 8 9	275	adolescents spent more time on screens than children; participants from minority
10 11	276	ethnicity groups and those who perceived their family income as inadequate had a greater
12 13	277	self-reported exposure to screen-based media. Those who described themselves as having
14 15	278	high grades in school (compared to low and moderate) spent less time on screens.
16 17 18	279	Participants classified as having obesity had a greater total screen time than those of all
19 20	280	other BMI categories and those who did not report their height and weight. Those who
21 22	281	did not report their BMI (height and/or weight) had less screen time (compared to
23 24	282	overweight) and those in the overweight category had greater screen time compared to
25 26 27	283	participants in the severe thinness/thinness/normal weight category. The same pattern of
28 29	284	results was observed for a weekend day, except for the findings on BMI, for which there
30 31	285	were only associations between those with obesity vs. all other categories
32 33	286	(Supplementary Table 1).
34 35 36	287	3.2 Social media exposure
37 38	288	The percentage of participants using different social media platforms across countries
39 40	289	is shown in <b>Figure 2</b> . Overall, 77% to 87% of children were using at least one of the
41 42	290	social media platforms, which varied by country. On average, the most commonly used
43 44 45	291	platform was Instagram (range: from 52% in Australia and the USA to 68% in Chile),
46 47	292	followed by Facebook (range: from 42% in Canada to 79% in Mexico), and Snapchat
48 49	293	(range: from 28% in Chile to 52% in the UK). TikTok usage ranged from 20% (Mexico)
50 51	294	to 32% (Canada) and Twitter usage ranged from 16% (Australia) to 34% (Mexico).
52 53 54	295	Participants who reported no social media application use ranged from 13% (Mexico) to
55 56		r anterpants who reported no social media appreation ase ranged from 1570 (intexied) to
57 58		

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

23% (Australia). The mean number of social media platforms used per respondent across countries is shown in Supplementary Figure S4, and ranged from 1.9 platforms (Australia and Chile) to 2.2 platforms (Mexico). Estimates from separate logistic regression models examining exposure to social media platforms across countries are shown in **Table 3**. Exposure to social media platforms differed by country and age group for all platforms, and significant differences by sex, perceived income adequacy, school grades and BMI for some platforms. Specifically, participants in Canada were less likely to use Facebook than those in all other countries, whereas participants in Mexico were more likely to use Facebook than those in all other countries. Those in Chile were more likely to use Instagram than those in all other countries. Participants from Canada were more likely to use TikTok than participants in Australia, Chile, Mexico, the UK. Participants in Mexico were more likely to use Twitter than participants in all other countries, and those in the UK were more likely to use Snapchat than those in all other countries except the USA. Participants in Australia were more likely to not use a social media platform compared to all other countries except the USA. Female participants were more likely to use Instagram, TikTok and Snapchat; adolescents (ages 14-17) were more likely to use all social media platforms except TikTok (compared to children ages 10-13); and ethnicity groups were not associated with exposure to social media platforms. Participants who perceived their family income as adequate were more likely to use Twitter; and participants who reported having high grades in school (compared to low and moderate) were less likely to use Facebook and TikTok. Those who were classified as having obesity were more likely to

**BMJ** Open

1		
2 3 4	318	use all social media platforms except Twitter compared to those whose BMI was is the
5 6	319	category "not reported".
7 8 9	320	3.3 Location of screen-based exposure to advertisements for unhealthy foods or
9 10 11	321	drinks
12 13	322	The percentage of children and adolescents who reported that they were exposed to
14 15	323	advertisements for unhealthy foods or drinks in three locations in the previous 30 days is
16 17 18	324	shown in Figure 3. Overall, TV shows, series or movies accounted for the largest number
19 20	325	of participants self-reporting exposure to advertisements (range: from 43% in the UK to
21 22	326	69% in Mexico and Chile), followed by websites or social media (range: from 27% in the
23 24 25	327	UK to 60% in Chile), and video or computer games (range: from 10% in Australia and
26 27	328	the UK to 17% in Chile).
28 29	329	3.4 Daily exposure to sugary beverage and fast food advertisements
30 31 32	330	The percentage of respondents who reported that they were exposed daily to
32 33 34	331	advertisements for both food categories in the last 30 days is shown in Figure 4. Self-
35 36	332	reported daily exposure to sugary drinks advertisements ranged from 10% (UK) to 43%
37 38	333	(Mexico). Self-reported daily exposure to fast food advertisements was relatively more
39 40 41	334	consistent across countries, with the exception of the UK (range: from 19% in the UK to
42 43	335	44% in the USA).
44 45	336	Estimates from separate logistic regression models examining daily exposure to
46 47 48	337	sugary beverage and fast food advertisements across countries are shown in Table 4.
49 50	338	Participants who self-reported more time spent on screen-based media were more likely
51 52	339	to report daily exposure to advertisements for both food categories. Daily exposure to
53 54 55	340	advertisements for sugary drinks and fast food differed by country, BMI and amount of
56 57		

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool .

Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies

2	
3	
4	
5	
6	
-	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	
~~	

1

341 exposure to screen-based media (total screen time in minutes), and patterns were mostly 342 similar across both food categories; there was no significant difference in exposure by 343 age group. Overall, participants in Mexico and Chile were much more likely to report 344 daily exposure to sugary beverage advertisements than participants in all other countries, 345 with fewer differences for fast food advertisements. Participants in the UK were less 346 likely to report daily exposure to advertisements of sugary drinks and fast food compared 347 to all other countries and those in the USA were more likely to report daily exposure to 348 fast food advertisements than those in all other countries. Participants who did not report 349 their height or weight were less likely to report daily exposure to advertisements for both 350 types of food categories compared to participants living with obesity, overweight or in 351 the severe thinness/thinness/normal weight category. There were no other significant 352 differences by socio-demographic characteristics. The same pattern of results was 353 observed for exposure to screen based media on a weekend day (Supplementary Table 354 S2).

355 4. Discussion

356 Summary of main findings

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

#### **BMJ** Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

were identified: participants in the UK reported less daily exposure to fast food and sugary drinks advertisements, whereas participants in the USA reported greater daily exposure to fast food advertisements. Most importantly, our results show that in all countries, self-reported exposure to advertisements increased with greater screen time. Analyses suggested important differences in exposure to screen-based media and social media platforms between age groups, with adolescents reporting an overall greater exposure to food advertisements. **Relationships with existing knowledge** The estimates from this study are similar to other international estimates of self-reported screen time. In the US, screen time among children 8-12 years in 2019 was estimated to be 4 hours 45 mins, and 7 hours and 22 minutes among 13-18 year olds,(31) compared to just over 9 hours in the current study among the older age group. A large national Canadian study from 2013-2014 suggest that youth ages 12 to 17 spent on average between 7.5 and 8 hours in front of screens daily, (32) very similar to the current findings of approximately 7.75 hours. In the current study, most children and adolescents are exceeding screen time guidelines across countries, which recommend entertainment screen time be limited to less than 2 hours daily for school-aged children and adolescents (33-35). Screen time has previously been associated with youth obesity (36, 37), poorer diet quality (38), and consumption of less healthy foods and beverages (39, 40). The general level of exposure reported among the sample, while an approximation, is cause for concern. The large proportion of children and adolescents using social media platforms has important implications for food and beverage marketing. Companies are increasingly

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

developing strategies to engage with their audience through these media platforms, which have a high likelihood of reaching children and adolescents even when they are not the primary target audience. Research from Canada has estimated that children were exposed to food and beverage marketing (of which the great majority is "less healthy") on social media apps 30 times per week while adolescents were exposed on average 189 times per week (22). In our study, children and adolescents generally reported using two social media platforms on average, therefore exposing them to various types and amounts of marketing strategies across platforms. For instance, Instagram—the most commonly reported social media platform among participants—is known to promote poor nutritional quality foods and beverages are commonly promoted through popular brand accounts using a range of marketing strategies that appeal to children and adolescents, such as competitions and the use of characters that appeal to children (41). Unhealthy food brands on Facebook are known to use techniques such as competitions based on user-generated content, interactive games, and apps.(42) These results suggest a high level of exposure via social media. In this study, a greater proportion of children and adolescents reported exposure to advertisements for unhealthy foods or drinks on television compared to websites, social media applications or gaming sites. Greater reporting may be in part due to the different types of advertising between these channels. In order for children to be aware of advertisements, they need to be able to identify the difference between an advertisement and other content, but also understand the persuasive intent behind the message (43).

408 Self-reported exposure to advertisements on television may have been higher as it is more

409 easily identifiable compared to digital marketing which often uses subtle marketing

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Page 21 of 47

#### **BMJ** Open

2		
3 4	410	techniques (e.g. such as celebrity endorsements by influencers and native advertising
5 6	411	designed to imitate editorial content) and is frequently disguised as entertainment (43,
7 8	412	44). On digital media, children and adolescents may simply be less able to discriminate
9 10 11	413	advertisements from other content, making marketing on these channels particularly
12 13	414	alarming. Digital marketing via advertisements is typically targeted, using cookies and
14 15	415	other means which record personal preferences, online activity, and location and these
16 17	416	data are then used to personalize and target the content of marketing to individual users,
18 19	417	therefore increasing the persuasive power of marketing (9, 11). The subtle advertising
20 21 22	418	techniques used on digital media, such as influencer endorsements or advergames may be
23		
24 25	419	more likely to bypass children's cognitive awareness. However, our data align with
26 27	420	marketing expenditure data, an objective indicator of marketing efforts by companies:
28 29	421	fast-food advertisement expenditures are the highest for television, although digital
30 31	422	marketing expenditures increased by 74% between 2012 and 2019 (45).
32 33	423	Self-reported daily exposure to advertisements was high for both fast food and sugary
34 35 36	424	drinks, with 34% and 25% of the sample reporting daily exposure, respectively, in all
37 38	425	countries. Perhaps unsurprisingly, those reporting more screen time were more likely to
39 40	426	be exposed daily to sugary drink and fast food advertisements. Differences across
41		
42 43	427	countries may in part relate to differences in restrictions on marketing directed at
44 45	428	children. In the UK, where participants were less likely to be exposed daily to
46 47	429	advertisements for fast food and sugary drinks than those in all other countries, a total
48 49	430	ban of advertisements for unhealthy foods and beverages has been in place since 2007
50 51 52	431	during and adjacent to television programs appealing to children and adolescents under
53 54 55 56	432	the age of 16 (46). While evidence on the impact of the UK policy is mixed, findings

1 ว		21
2 3 4	433	suggests that despite some changes in children's exposure, advertisements typically
5 6	434	shifted to other media channels, implying important loopholes in regulations (47, 48). In
7 8 9	435	the USA, where participants were more likely to report daily exposure to fast food
10 11	436	advertisements than those in all other countries, voluntary self-regulatory approaches to
12 13	437	restrict marketing by the industry are the only form of marketing restrictions, which
14 15	438	target children under 12 years of age on media where the audience is mostly children
16 17 18	439	(49), and have largely proven ineffective at decreasing children's exposure to marketing
19 20	440	for unhealthy products (45, 50, 51). It is important to note that the present study cannot
21 22	441	capture the effectiveness of restrictive marketing policies by its cross-sectional design,
23 24 25	442	but studying trends in both screen-time and social media use and self-reported exposure
26 27 28 29 30 31 32	443	annually over time using the IFPS should help evaluate the impact of impending policies,
	444	such as the recently announced policy in the UK which will ban online advertising by the
	445	end of 2022 and ban advertising of foods high in fat, sugar and salt between 5:30 am and
33 34	446	9 pm (52-54).
35 36	447	Age group was an important predictor for screen-based media and social media
37 38	448	exposure, with adolescents spending more time on screens and using social media
39 40 41	449	platforms more than children. Adolescents may be an age group of particular interest to
42 43	450	marketers because of their greater spending power compared to children, which also
44 45	451	increases with age, therefore having the potential to create life-long brand relationships
46 47 48	452	and product consumers (55, 56). Marketers target adolescents through digital media by
49 50	453	using "ubiquitous connectivity, personalization, peer-to-peer networking, engagement,
51 52	454	immersion and content creation", which are features especially appealing to this age
53 54 55 56 57	455	group (56). In our study, there were no differences in daily self-reported exposure to

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

#### **BMJ** Open

	456	sugary drink and fast food advertisements between children and adolescents. Despite
	457	adolescents having an improved ability to recognize advertisement content and the
	458	persuasive intent of marketing compared to their younger counterparts, adolescents may
)	459	be even more vulnerable to digital food marketing, because of their increased use of these
<u>!</u>	460	platforms as well as desire to conform with social norms in their peer group (57, 58).
+ ;	461	Greater exposure to digital and social media platforms may also increase the number of
) 7 }	462	subtle marketing strategies, for example viral marketing (peer-to-peer), contests, quizzes
)	463	and marketing by influencers, which may not be captured in self-report measures if the
2	464	participant is unable to identify these as marketing strategies.
; ; ;	465	4.1 Strengths and limitations
) ,	466	This study has a large sample size, and the same measures were used across countries,
; )	467	allowing justifiable comparisons between countries. Many studies use expenditures or
)	468	gross ratings points, which provide objective data, but do not indicate who is exposed at
-  -  -	469	the individual level, including individual-level correlates. Furthermore, these traditional
5	470	approaches are less effective for digital media. More intensive approaches—such as
}	471	devices that directly monitor websites or device usage—provide precise measures of
)	472	exposure but are typically less feasible at a population level. One of the major strengths
<u>-</u>	473	of this study is the wide range of social media platforms, and the differentiated locations
- 	474	of exposure to screen-based marketing assessed. Self-reported exposure to food
) 7 }	475	marketing is a method used by researchers in large population samples (57, 59, 60) as a
)	476	subjective indicator of actual exposure, the latter likely to be higher because of the
2	477	frequent and implicit nature of marketing, resulting in a probable underestimation of
•  -  -	478	exposure to marketing. Our measures may further underestimate exposure as such a

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2	
2	
ر ۸	
4	
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 19 20 22 23 24 25 26 27 28 30 31 32 33 34 35 367 378 37	
6	
7	
8	
9	
10	
11	
11	
12	
13	
14	
15	
16	
17	
18	
10	
17 20	
20	
21	
22	
23	
24	
25	
26	
27	
27	
28	
29	
30	
31	
32	
33	
34	
25	
22	
30	
37	
38	
39	
40	
41	
42	
43	
44 4	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	
50	

479	measure may be less reliable in a sample of children and adolescents due to poor recall,
480	and inability to recognize all forms of marketing (particularly in digital media) (61).
481	This study is subject to limitations common to survey research. Respondents were
482	recruited using non-probability based sampling; therefore, although the data were
483	weighted by age group, sex, region, and ethnicity (except in Canada), the findings do not
484	provide nationally representative estimates. In addition, there were notably higher levels
485	of missing data for BMI in the UK. The measures used also have some limitations. For
486	example, time spent watching cable television vs. on streaming applications (Netflix,
487	Crave, Amazon Prime Video, etc.) was not distinguished in this study. The amount of
488	marketing exposure on cable television compared to streaming platforms is likely very
489	different, and this may play an important role in understanding the amount of exposure.
490	Additionally, children and adolescents retrospectively self-reported the estimated screen
491	time spent on each media channel rather than using a more objective approach, and this
492	may have been influenced by whether or not a parent was present when completing the
493	survey. This approach has not yet been validated in the literature, but nevertheless seems
494	comparable to self-report estimates from other surveys. Responses may not be precisely
495	accurate, and likely overestimate the absolute amount of screen time reported by youth as
496	the measure does not take into account simultaneous use of multiple screens.
497	Nevertheless, this tool allows for comparisons of the relative amount of exposure across
498	countries, as it is likely that the challenge of estimations, and associated error, would be
499	similar across countries. Lastly, the measures did not distinguish between recreational
500	screen time and screen time that was spent for school purposes (e.g., on websites).
501	4.2 Policy implications

Page 25 of 47

# BMJ Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2		
3 4	502	These results reinforce the need to implement restrictive policies on marketing of
5 6	503	unhealthy food and beverages targeting children and adolescents, not only on television
7 8 9	504	but also on digital media considering the widespread usage of social media platforms
9 10 11	505	among children and adolescents across countries and the persuasiveness of marketing that
12 13	506	is often targeted. Future research examining the exposure to digital marketing to children,
14 15	507	as well as research modelling of the impact of potential policy measures, are likely to be
16 17	508	important in making the case for restricting less healthy food and beverage content via
18 19 20	509	these channels (62). This study also demonstrated the variety of media channels that are
21 22	510	being used by children and adolescents, even though their content may not be 'child-
23 24	511	targeted'(63) (i.e., social media, websites, etc.) but are indeed 'child appealing'(62, 64).
25 26 27	512	Almost all social media platforms (such as Instagram, Facebook and Snapchat) have a
28 29	513	minimum age of 13 to register (65-67), but nearly a quarter of children aged 8 to 11 years
30 31	514	have an account (68), demonstrating that self-imposed age-restrictions are not effective.
32 33 34	515	The association between use and self-reported exposure further demonstrates the need for
35 36	516	restrictions to limit exposure to this vulnerable age group.
37 38	517	The results of our study will be useful for future research as a baseline for comparison
39 40 41	518	with exposure to unhealthy food marketing after the implementation of marketing
41 42 43	519	policies, but also in comparing children's and adolescent's exposure to screen-based
44 45	520	media and marketing after important worldwide events leading to possible changes in
46 47	521	media consumption habits, such as the COVID-19 pandemic.
48 49 50	522	
51 52	523	
53 54	524	
55 56 57		
58		
59 60		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool .

Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies

1		
2 3 4	525	Ethics statement
5 6	526	The study was reviewed by and received ethics clearance through a University of
7 8	527	Waterloo Research Ethics Committee (ORE# 41477) and Laval University Ethics
9 10 11	528	Committee (#2021-318). All participants provided informed consent to take part.
12 13	529	
14 15	530	Contributorship statement
16 17 18	531	LV, CMW and DH designed research; CMW conducted research; EDP analyzed data and
19 20	532	wrote the paper; LV had primary responsibility for final content; MW, MPK, DH, CN,
21 22	533	CMW, XZ and LV reviewed and edited the manuscript. All authors read and approved
23 24 25	534	the final manuscript.
25 26 27	535	
28 29	536	Competing interests
30 31	537	None declared.
32 33 34	538	
35 36	539	Funding
37 38	540	This work was supported by the Public Health Agency of Canada (PHAC, no grant
39 40 41	541	number available), with additional support from a Canadian Institutes of Health Research
42 43	542	(CIHR) Project Grant (PJT-162167).
44 45	543	
46 47 48	544	Data availability statement
48 49 50	545	Data are available upon reasonable request. Data are available directly from the
51 52	546	International Food Policy Study team on reasonable request (see
53 54	547	www.foodpolicystudy.com).
55 56 57		
58 59		
60		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

## 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: <u>https://doi.org/10.1086/209559</u>.
- 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.
- 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: <u>https://www.facebook.com/business/news/Ad-Week-UK</u> (accessed October 3 2021).
- 17. Ofcom. Children and Parents: Media Use and Attitudes Report. 2015.

- 18. Of com. 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.
- 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.

2 3

4

5

6 7

8

9

10

11

12 13

14

15

16

17

18 19

20

21

22

23 24

25

26

27

28

29 30

31

32

33

34 35

36

37

38

39

40 41

42

43

44

45 46

47

48

49

50

51 52

53

- **BMJ** Open 28 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 vouth? 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. Canadian 24-Hour Movement Guidelines for Children and Youth. An Integration of 34. Physical Activity, Sedentary Behaviour, and Sleep. 2021. Sociedad Chilena de Pediatria. Ninos y dispositivos electronicos: lo bueno y lo malo 35. 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. Paisi M, Witton R, Plessas A. Is there an association between children's screen use 38. 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. Vassallo AJ, Kelly B, Zhang L, Wang Z, Young S, Freeman B. Junk Food Marketing 41. 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.
  - Harris JL, Fleming-Milici, F., Phaneuf, L., Jensen, M., Choi, Y. Y., McCann, M., 45. Mancini, S. Fast food advertising : Billions in spending, continued high exposure by youth. Rudd Center for Food Policy and Obesity 2021.
  - House of Commons Library. Advertising to children. 2021. 46.

- 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.
- 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, Pauzé E, Potvin Kent M, White CM, Hammond D. A comparison of self-reported exposure to fast food and sugary drinks marketing

		50
1 2		
3		
4		among parents of children across five countries. Prev Med 2021;147:106521. doi:
5		10.1016/j.ypmed.2021.106521.
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	63.	Tatlow-Golden M, Garde A. Digital food marketing to children: Exploitation,
16		surveillance and rights violations. Global Food Security 2020;27:100423.
17	64	
18 19	64.	World Cancer Research Fund International. How digital media markets unhealthy
20		foods to children. 2017.
20	65.	Snap Inc. Internet: <u>https://www.snap.com/en-US/terms</u> (accessed 3 October
22		2021).
23	66.	Instagram. Internet: https://help.instagram.com/581066165581870# (accessed 3
24		October 2021).
25	67.	Facebook. Internet: <u>https://www.facebook.com/help/157793540954833/</u>
26	07.	
27		(accessed October 3 2021).
28	68.	Ofcom. Children and Parents: Media Use and Attitudes Report. 2017.
29		
30		
31		
32		
33		
34		
35		
36 37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		
49		
50		
51		
52		
53		
54 55		
55 56		
50 57		
58		

BLESTable 1. Sample characteristics of children and adolescents in sCharacteristicAll countries A $(N=9171)$ Age (years)50 (4551)10-1350 (4551)14-1750 (4620)Sex51 (4664)Male51 (4664)Female49 (4507)		BMJ Open			0.1136/bmj :ted by cop		
JES		s in six countries (weighted) N = 9171. s Australia Canada Chile Medice UK USA (n=1127) (n=2869) (n=1124) (n=505) (n=1140) (n=1406) $\frac{\sqrt{6} (n)}{\sqrt{6} (n)}$ 51 (574) 50 (1438) 47 (534) 50 (max) 49 (553) 50 (1431) 53 (590) 50 (max) 52 (582) 50 (1446) 51 (572) 51 (max) 52 (582) 50 (1446) 51 (572) 51 (max) 53 (590) 50 (max) 51 (578) 51 (713) 52 (582) 50 (1446) 51 (572) 51 (max) 53 (590) 50 (max) 51 (578) 51 (713) 52 (582) 50 (1446) 51 (572) 51 (max) 53 (590) 50 (max) 53 (590) 50 (max) 54 (545) 50 (1423) 49 (552) 49 (max) 55 (559) 49 (684) 75 (850) 73 (2098) 85 (958) 78 (max) 75 (850) 73 (2098) 85 (958) 78 (max) 51 (719) 83 (941) 68 (959) 25 (277) 27 (771) 15 (166) 22 (max) 51 (578) 51 (719) 32 (447)					
Table 1. Sample characteristics of children	and adolescents	in six count	ries (weighted	l) N = 9171.	-2021-058 t, includin		
					Metricg		
Characteristic	(N=9171)	(n=1127)	(n=2869)	· /	(n= <b>1</b> 505)	(n=1140)	(n=
				% (n)	°r <u> </u>		
	50 (4551)	51 (574)	50 (1/38)	17 (534)		10 (562)	10 (
	· · · · ·	· · · ·	· /	· · ·	50 (755)	· · · ·	
	50 (4020)	4) (333)	50 (1451)	55 (570)	Text	51 (570)	51
	51 (4664)	52 (582)	50 (1446)	51 (572)	51 (2) (2) (2)	51 (581)	51 (
		· · ·	· · · ·	· · ·	49 (2744)		
Ethnicity		- ( )			ata i	- ()	-
Majority group	76 (6976)	75 (850)	73 (2098)	85 (958)	78 ( <b>±</b> 17 <b>8</b> )	83 (941)	68 (
Minority group	24 (2195)	25 (277)	27 (771)	15 (166)	22 🛱 3 🗲	17 (199)	
School grades					≥ ≚		
Low	16 (1461)	32 (365)	13 (373)	6 (65)	7 (101) 36 (101) 36 (101)	29 (334)	16 (
Mid	38 (3508)	38 (430)	34 (974)	49 (555)	36 🛃 49 🎽	38 (430)	41 (
High	46 (4202)	29 (332)	53 (1522)	45 (505)	57 🖓 55	33 (375)	44 (
Perceived Income Adequacy					nd s		
Inadequate	24 (2222)	25 (283)	17 (488)	31 (345)	28 🗃 18	26 (291)	28 (
Adequate	76 (6949)	75 (844)	83 (2381)	69 (779)	72 (1083)	74 (849)	72 (
BMI					48 (7)17e		
Severe thinness/thinness/normal weight	49 (4480)	45 (509)	57 (1630)	43 (478)	48 (717)	41 (462)	49 (
Overweight	18 (1665)	16 (176)	16 (473)	21 (231)	22 <b>(2</b> 34)	13 (147)	22 (
Obesity	10 (927)	10 (113)	9 (255)	9 (97)	10 🧖 48 <mark>8</mark>	8 (92)	16 (
Not reported	23 (2100)	29 (328)	18 (511)	28 (319)	20 (306)	39 (439)	14 (
					Department GEZ-LTA		

 Page 32 of 47

#### BMJ Open

Parameter	Weeka	lay screen time		
	Wald $\chi^2$	B (CI)		
Country	64.2	· · ·		
AUS vs. CAN	-18.	-18.1 (-47.2,11.0)		
AUS vs. CHILE	-170	0.2 (-205.8,-134.5)		
AUS vs. MEX	-144	-144.3 (-179.3,-109.3)		
AUS vs. UK	-26.	-26.8 (-60.7,7.2)		
AUS vs. USA	-107	7.8 (-142.6,-72.9)		
CAN vs. CHILE		2.1 (-181.9,-122.3)		
CAN vs. MEX		5.2 (-154.9,-97.5)		
CAN vs. UK		(-37.7,20.3)		
CAN vs. USA		7 (-118.2,-61.1)		
CHILE vs. MEX		(-9.1,60.8)		
CHILE vs. UK		4 (107.9,178.9)		
CHILE vs. USA		(26.7,98.0)		
MEX vs. UK		6 (82.7,152.4)		
MEX vs. USA		(1.9,71.2)		
UK vs. USA		0 (-116.1,-45.9)		
Sex Sex	25.3	0 (-110.1,-45.7)		
Female vs. male		7 (-52.4,-16.9)		
Age	209.4	7 (-52.4,-10.7)		
10-13 years vs. 14-17 years		7 (-117.4,-81.9)		
Ethnicity	-99.	/ (-11/.4,-01.9)		
		0(622, 156)		
Majority vs. minority	-58.3	9 (-62.2,-15.6)		
Perceived income adequacy		0(542,110)		
Adequate vs. inadequate		0 (-54.3,-11.8)		
School grades	19.9	(007.272)		
High vs. low		0 (-90.7,-37.2)		
High vs. mid		6 (-46.2,-7.0)		
Low vs. mid		(10.6,64.1)		
BMI	16.9			
Not reported vs. Obesity		5 (-102.2,-32.8)		
Not reported vs. Overweight		8 (-57.2,-0.3)		
Not reported vs. Severe thinness/thinness/normal weight		(-10.3,35.1)		
Obesity vs. Overweight		(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=Mexic	co, UK=United K	ingdom, USA=U		
States of America; B=Beta; CI = 99% confidence interval.				

BMJ Open Table 3. Estimates from separate logistic regression models examining self-reported exposure to social media platforms among children and adolescents in six countries (1) - 136/0 -

Parameter	Exposure to Facebook	$\frac{\text{Exposure to Instagram}}{\text{Wald }\chi^2 \text{ Odds ratio (CI)}}$	$\frac{\text{Exposure to TikTok}}{\text{Wald } \chi^2 \text{ Odds ratio (CI)}}$	$\frac{\text{Exposure to Twitter}}{\text{Wald }\chi^2 \text{ Odds ratio (CI)}}$	Exposure to Snapchat	No exposure to social media
	Wald $\chi^2$ Odds ratio (CI)				Vald Odds ratio (CI)	Wald $\chi^2$ Odds ratio (CI)
Country	81.7	17.6	15.2	28.4	<b>26</b> .3 <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b> <b>10</b>	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)	<b>full</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b>ing</b> <b></b>	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)	<b>n g</b> 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)	<b>T 1 1</b> .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)	<b>9</b> 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)	<b>u u</b> 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)	<b>G O</b> 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)	$ \begin{array}{c} \textbf{x} \\ \textbf{x} \\ \textbf{z} \\ \textbf$	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)		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)	<b>Te</b> a <b>C</b> 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)	<b>d m 2</b> 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)		0.92 (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)	<b>e čo</b> 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)	<b>G S</b> 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)	an $0.46(0.36,0.59)$	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		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)	<b>a b a</b> 1.87 (1.65,2.12)	0.55 (0.47,0.65)
Age	601.2	705.2	30.1	380.7	1.87 (1.65,2.12) i.6.40n 0.37 (0.32,0.42) 0.97 (0.83,1.14) 0.96 (0.83,1.12) 0.96 (0.83,1.12) 0.83 (0.69,1.00) 0.83 (0.69,1.00) 0.97 (0.72,0.02)	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)	<b>D</b> .37 (0.32,0.42)	6.24 (5.14,7.58)
Ethnicity	0.4	1.5	0.0	2.3		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		0.1
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)	a 0.96 (0.83,1.12)	1.02 (0.84,1.23)
School grades	11.1	2.3	10.2	2.1	<b>1 1 1 1 1 1 1 1 1 1</b>	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)		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)	an $0.99(0.82,1.19)$	0.95 (0.74,1.22)
BMI	12.1	7.8	3.0	4.1	0.82 (0.72,0.95) 0.99 (0.82,1.19)	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)	<b>6</b> , <b>8</b> , <b>8</b> , <b>9</b> , <b>1</b>	1.86 (1.38,2.52)
Not reported vs. Obesity Not reported vs. Overweight	0.72 (0.59,0.89)	0.74 (0.58,0.94)	0.85 (0.69,1.05)	0.77 (0.58,1.02) 0.78 (0.61,0.98)	$\mathbf{n}_{\mathbf{i}} = \underbrace{0}_{0.69} \underbrace{(0.56, 0.90)}_{0.69}$	1.59 (1.24,2.04)
Not reported vs. Overweight	0.72 (0.39,0.89)	0.74 (0.01,0.90)	0.85 (0.09,1.05)	0.78 (0.01,0.98)	and 3.8 (0.72,0.93) and 3.8 (0.72,0.93) and 3.8 (0.99 (0.82,1.19) 0.99 (0.82,1.19) 0.71 (0.56,0.90) 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)	techno 0.72 (0.61,0.85) 0.97 (0.76,1.24)	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)	Chine 0.72 (0.61,0.85) 0.97 (0.76,1.24)	0.85 (0.62,1.18)
Obesity vs. Severe thinness/thinness/normal					ol	
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)	logie 7, 1.02 (0.82,1.26)	0.71 (0.53,0.95)
Overweight vs. Severe					gies 20 1.02 (0.82,1.26)	
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)	ມ 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. 

Department GEZ-LTA

Page 35 of 47

1

2

3 4 \_

#### **BMJ** Open

34

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).

		osure to sugary drinks	Daily ex	posure to fast food
Parameter	ads		ads	
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
Country	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
Sex	1.5		0.4	
Female vs. male		1.07 (0.93,1.23)	•••	1.03 (0.91,1.17)
Age	0.0	((,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1.2	
10-13 years vs. 14-17 years	0.0	1.00 (0.86,1.16)		0.95 (0.83,1.08)
Ethnicity	0.1		0.0	0.50 (0.00,1.00)
Majority vs. minority	011	1.02 (0.85,1.23)	010	1.00 (0.85,1.18)
Perceived income adequacy	1.0	1.02 (0.00,1.20)	4.5	1.00 (0.00,1.10)
Adequate vs. inadequate	1.0	0.94 (0.80,1.11)	1.0	0.88 (0.76,1.03)
School grades	0.4	0.91 (0.00,1.11)	3.2	0.00 (0.70,1.05)
High vs. low	0.1	0.93 (0.75,1.17)	5.2	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)
BMI	6.3*	1.05 (0.05,1.27)	6.4*	0.92 (0.70,1.11)
Not reported vs. Obesity	0.5	0.73 (0.56,0.95)	0.1	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		0.70 (0.20,0.00)		0.75 (0.01,0.72)
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. Overweight Obesity vs. Severe		0.70 (0.77,1.23)		1.01 (0.77,1.20)
thinness/thinness/normal weight		1.09 (0.86,1.38)		1.05 (0.85,1.30)
Overweight vs. Severe		1.07 (0.00,1.30)		1.05 (0.05,1.50)
thinness/thinness/normal weight		1.14 (0.94,1.38)		1.04 (0.88,1.24)
uniness/uniness/normal/weight	88.2*	1.05 (1.04,1.07)	121.4*	1.04 (0.88,1.24)

Note : The variable listed second is the reference variable. Exposure to screen based media is expressed in 57 minutes. 58

Abbreviations: AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval. 59

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool .

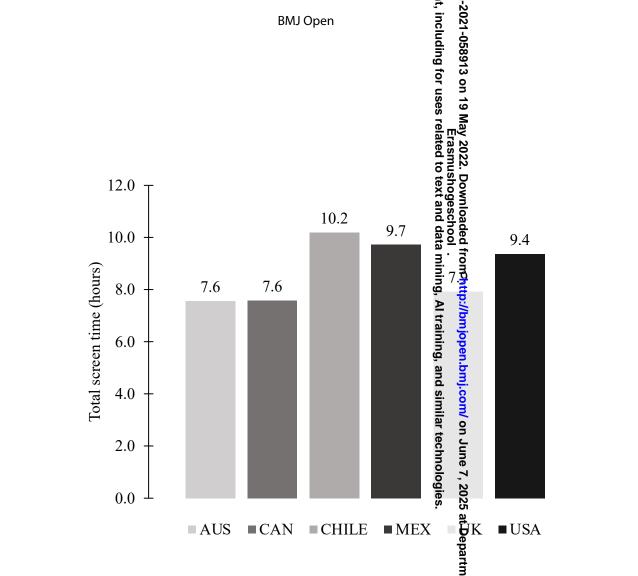
# **FIGURES**

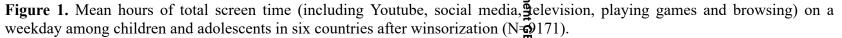
Figure 1. Mean hours of total screen time (including Youtube, social media, television, playing games and browsing) on a weekday among children and adolescents in six countries after winsorization (N=9171).

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 the self-reporting exposure t

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).

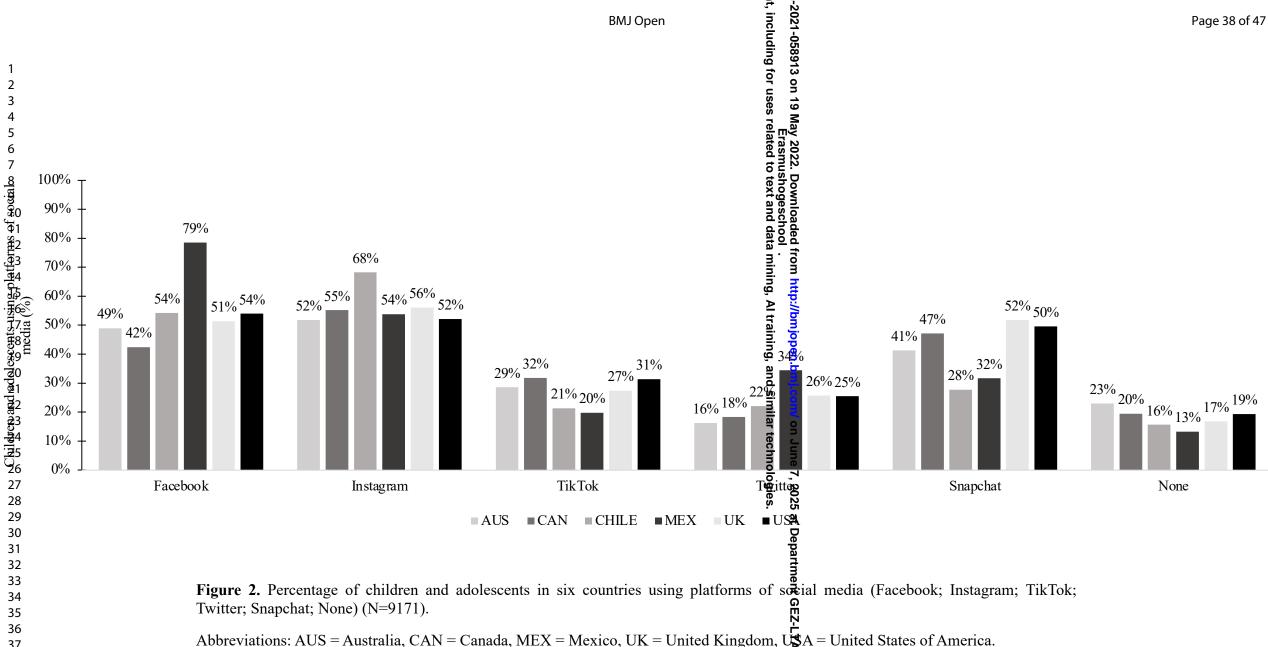
computer games) in the last 30 days (N=9171).
Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States
of America.
Figure 4. Percentage of children and adolescents in six countries self-reporting daily exposure to marketing for
sugary drinks and fast food in the last 30 days (N=9171).
Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States
of America.



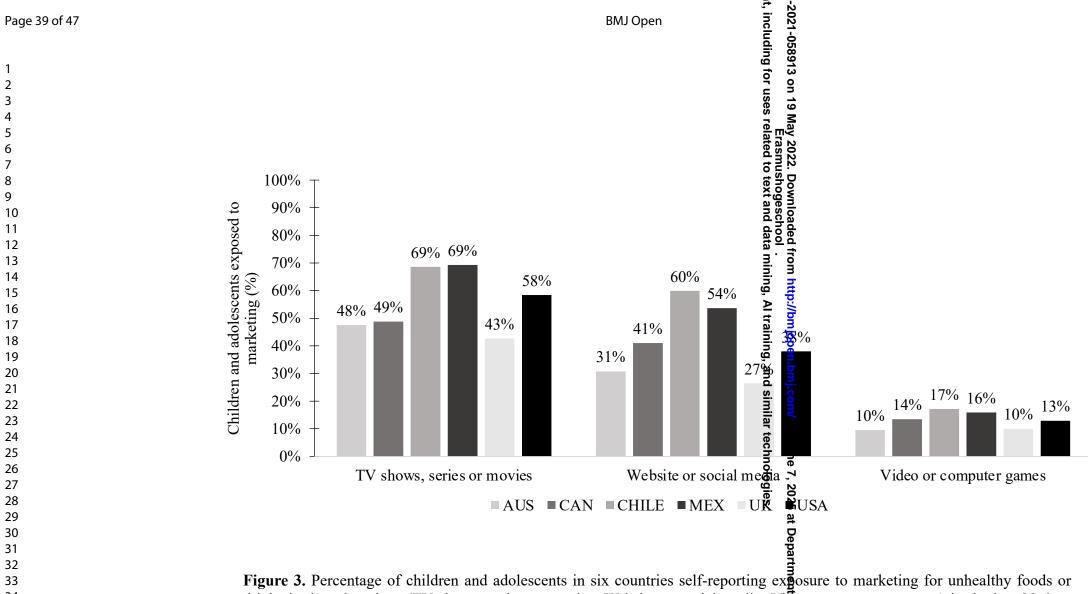


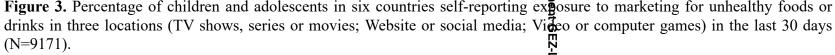
Abbreviations: AUS = Australia, CAN = Canada, MEX = Mexico, UK = United **É**ingdom, USA = United States of America.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml



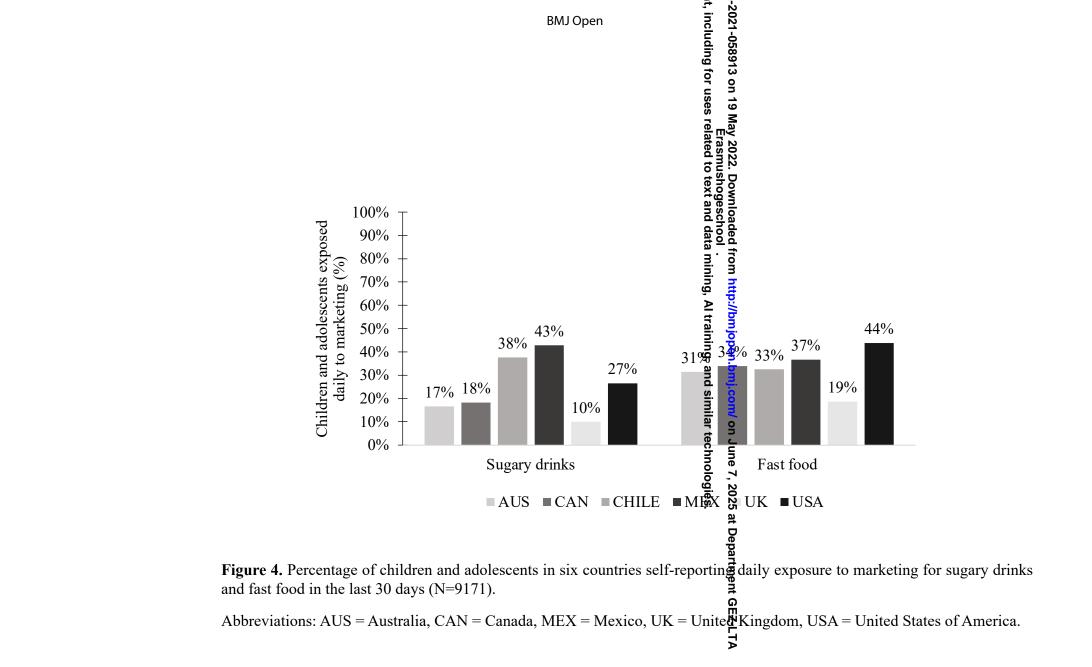
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml





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

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml



 Page 40 of 47

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

## **BMJ** Open

# 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 selfreported exposure to screen-based media (in minutes) on a weekend day among children and adolescents in six countries (N=9171).

3	Parameter	Weekend day screen time		
0		Wald $\chi^2$	B (CI)	
1	Country	47.0*		
2	AUS vs. CAN		-6.8 (-35.7,22.0)	
3	AUS vs. CHILE		-136.9 (-173.8,-100.0)	
4	AUS vs. MEX		-130.0 (-165.4,-94.7)	
5 6	AUS vs. UK		-26.7 (-60.8,7.4)	
7	AUS vs. USA		-85.6 (-120.1,-51.1)	
8	CAN vs. CHILE		-130.1 (-161.3,-98.8)	
9	CAN vs. MEX		-123.2 (-152.1, -94.2)	
20	CAN vs. UK		-19.8 (-48.7,9.0)	
21	CAN vs. USA		-78.8 (-107.0,-50.6)	
22	CHILE vs. MEX		6.9 (-29.7,43.5)	
23	CHILE vs. UK		110.2 (73.4,147.1)	
24	CHILE vs. USA		51.3 (14.5,88.1)	
25	MEX vs. UK		103.3 (68.2,138.5)	
26	MEX vs. USA		44.4 (9.6,79.2)	
27	UK vs. USA		-58.9 (-93.8,-24.1)	
28	AUS vs. USA CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. WK CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA UK vs. USA UK vs. USA Sex Female vs. male Age 10-13 years vs. 14-17 years Ethnicity Majority vs. minority Perceived income adequacy Adequate vs. inadequate	15.0*		
29	Female vs. male	1010	-27.0 (-44.9,-9.0)	
80 81	Age	167.5*		
82	10-13 years vs. 14-17 years	10/10	-90.3 (-108.3,-72.4)	
33	Ethnicity	13.0*	<i>y</i> 0.5 (100.5, <i>y</i> 2.1)	
34	Majority vs. minority	15.0	-32.9 (-56.3,-9.4)	
85	Perceived income adequacy	32.0*	52.9 ( 50.5, 5.4)	
86	Adequate vs. inadequate	52.0	-47.2 (-68.8,-25.7)	
87	School grades	30.7*	47.2 ( 00.0, 23.7)	
88	High vs. low	50.7	-79.7 (-106.7,-52.6)	
89	High vs. mid		-35.8 (-55.6,-16.1)	
10	Low vs. mid		43.8 (16.9,70.7)	
1	BMI	10.7*	45.8 (10.5,70.7)	
2	Not reported vs. Obesity	10.7	-66.2 (-100.0,-32.4)	
13	Not reported vs. Overweight		-20.6 (-48.6,7.4)	
4	Not reported vs. Overweight Not reported vs. Severe thinness/thinness/normal weight		-2.0 (-25.2,21.1)	
15 16	Obesity vs. Overweight		45.6 (10.8,80.4)	
l6 17				
17 18	Obesity vs. Severe thinness/thinness/normal weight		64.2 (32.9,95.5)	
ю 19	Overweight vs. Severe thinness/thinness/normal weight * : Indicates significant Wald $\chi^2$ test.		18.6 (-5.9,43.0)	

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).

	Daily exp	osure to sugary drinks		
Parameter	_	ads		osure to fast food ad
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
Country	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)
Sex	1.3		0.3	
Female vs. male		1.07 (0.92,1.23)		1.03 (0.91,1.17)
Age	0.0		0.7	
10-13 years vs. 14-17 years		1.01 (0.87,1.17)		0.96 (0.84,1.09)
Ethnicity	0.0		0.0	
Majority vs. minority		1.02 (0.85,1.23)		1.00 (0.85,1.18)
Perceived income adequacy	0.5		3.1	
Adequate vs. inadequate		0.95 (0.81,1.13)		0.90 (0.78,1.05)
School grades	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)
BMI	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				(00,2.20)
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)
Exposure to screen based media (weel	kend	(		(,
day)	128.7*	1.06 (1.05,1.08)	186.5*	1.07 (1.06,1.08)

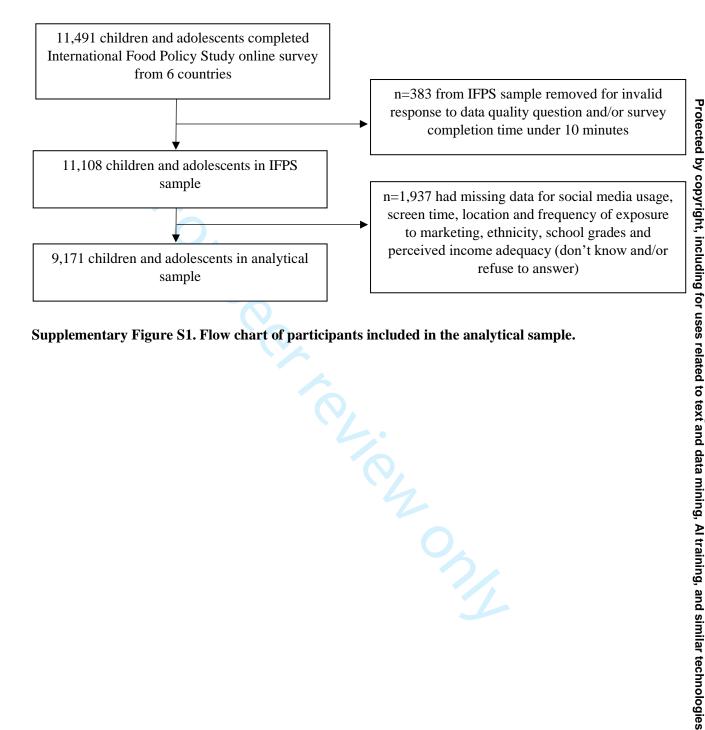
Abbreviations : CAN=Canada, AUS=Australia, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

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

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

# SUPPLEMENTARY MATERIAL - DEMERS-POTVIN ET AL.

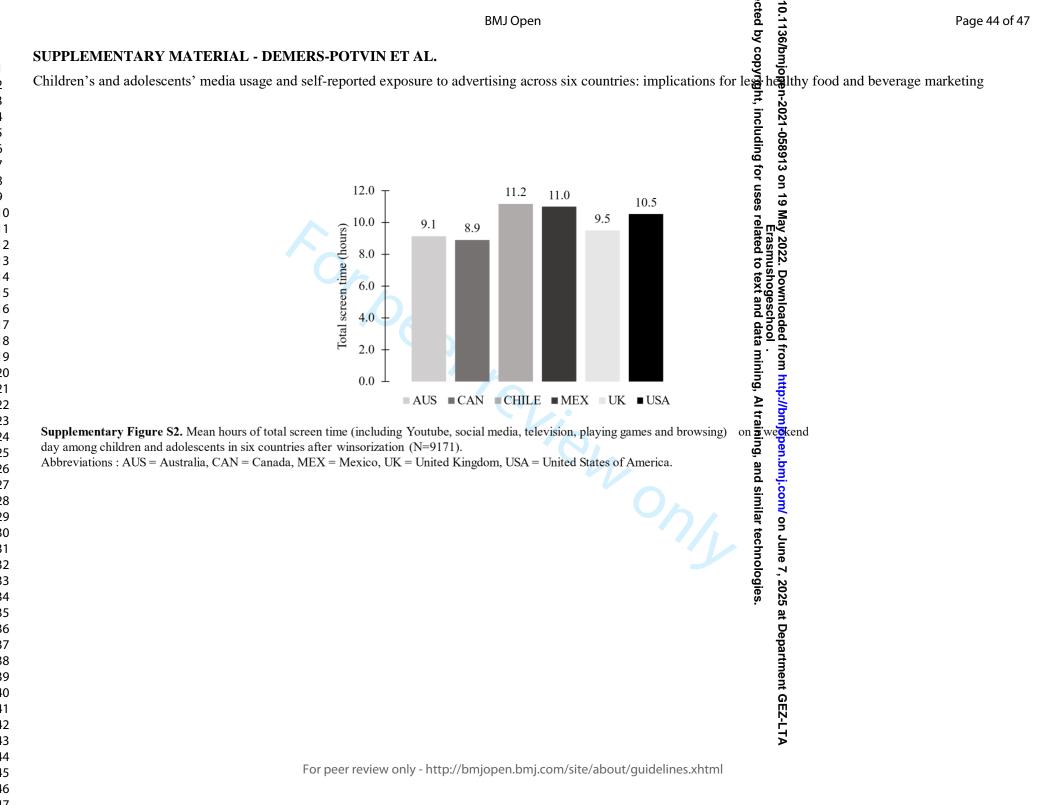
Children's and adolescents' media usage and self-reported exposure to advertising across six countries: implications for less healthy food and beverage marketing

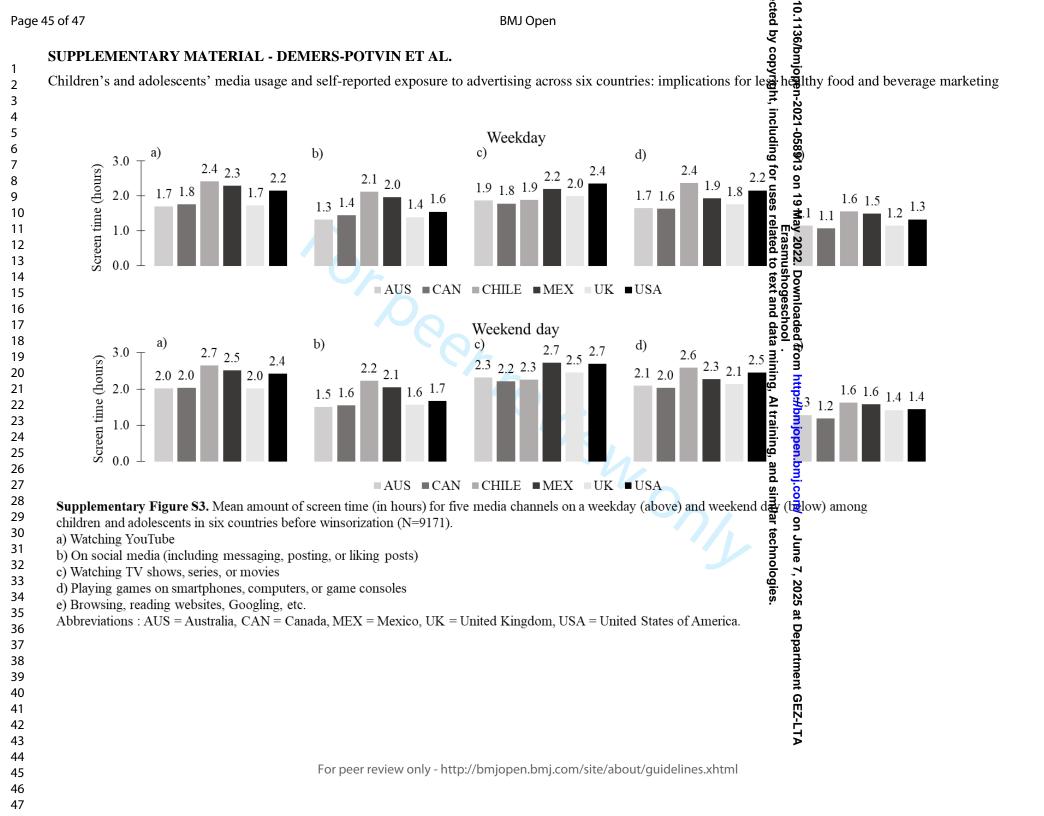


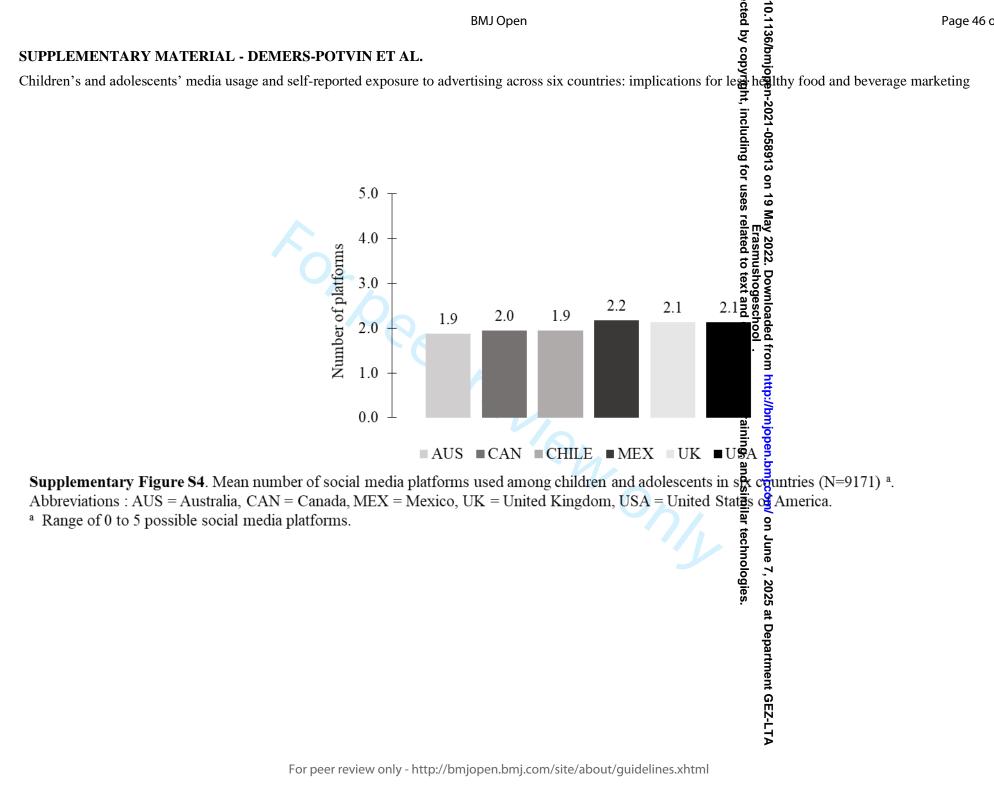
# Supplementary Figure S1. Flow chart of participants included in the analytical sample.

rezer onz









	Item No	Recommendation	Page No
Title and abstract	1	( <i>a</i> ) Indicate the study's design with a commonly used term in the title or the abstract	3
		( <i>b</i> ) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
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
Methods			
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	( <i>a</i> ) 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/	8*	For each variable of interest, give sources of data and details of methods	8-11
measurement		of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
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	( <i>a</i> ) 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
		( <i>d</i> ) If applicable, describe analytical methods taking account of sampling strategy	13
		( <i>e</i> ) Describe any sensitivity analyses	-
Results			
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
Outcome data	15*	Report numbers of outcome events or summary measures	14-16
Main results	16	( <i>a</i> ) 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

Érasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
23 24
24 25
25 26
20
27
28 29
~ ~
30 31
32
32 33
34 35
36
37
38 39
40
41
42
43
44
45
46
47 48
40 49
49 50
50 51
52
52 53
53 54
54 55
55 56
50 57
57 58
58 59
29

60

1 2

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

\*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.

# **BMJ Open**

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

	1
Journal:	BMJ Open
Manuscript ID	bmjopen-2021-058913.R1
Article Type:	Original research
Date Submitted by the Author:	25-Mar-2022
Complete List of Authors:	Demers-Potvin, Élisabeth; Université Laval, École de nutrition, Centre de nutrition, santé et société (NUTRISS) White, Martin; University of Cambridge, Centre for Diet and Activity Research (CEDAR), MRC Epidemiology Unit Potvin Kent, Monique; University of Ottawa, School of Epidemiology and Public Health, Faculty of Medicine Nieto, Claudia; National Institute of Public Health, Center for Health and Nutrition Research White, Christine; University of Waterloo, School of Public Health Sciences, Faculty of Health Zheng, Xueying; St Helens and Knowsley Teaching Hospitals NHS Trust Hammond, D; University of Waterloo Vanderlee, Lana; Universite Laval, École de nutrition, Centre de nutrition, santé et société (NUTRISS)
<b>Primary Subject Heading</b> :	Public health
Secondary Subject Heading:	Health policy
Keywords:	Health policy < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, NUTRITION & DIETETICS, PUBLIC HEALTH

# SCHOLARONE<sup>™</sup> Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our <u>licence</u>.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which <u>Creative Commons</u> licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

terez oni

Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies



BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool .

rasmushogescl

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

Adolescents' media usage and self-reported exposure to advertising across six

countries: implications for less healthy food and beverage marketing

Élisabeth Demers-Potvin, Martin White, Monique Potvin Kent, Claudia Nieto, Christine

M. White, Xueying Zheng, David Hammond, Lana Vanderlee\*

École de Nutrition, Centre de nutrition, santé et société (NUTRISS), Université Laval, Québec, Québec G1V 0A6, Canada (ÉDP, LV)

UKCRC Centre for Diet and Activity Research (CEDAR), MRC Epidemiology Unit, University of Cambridge School of Clinical Medicine, Cambridge CB2 0QQ, UK (MW)

School of Epidemiology and Public Health, Faculty of Medicine, University of Ottawa, Ottawa, Ontario K1G 5Z3, Canada (MPK)

School of Public Health Sciences, Faculty of Health, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada (DH, CMW)

Center for Health and Nutrition Research, National Institute of Public Health, Cuernavaca, Morelos, Mexico (CN)

St Helens and Knowsley Teaching Hospitals NHS Trust, Rainhill, L35 5DR, UK (XZ)

# \*Corresponding author:

Lana Vanderlee, PhD 2440, boulevard Hochelaga, Québec, Québec (Canada), G1V 0A6 Telephone: 519-498-3555 Email: lana.vanderlee@fsaa.ulaval.ca

# Abbreviations

IFPS : International Food Policy Study

UK : United Kingdom

USA : United States of America

Word count : 5780

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

BMJ Open

1	ABSTRACT
2	<b>Objectives:</b> 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	<b>Results:</b> 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

# BMJ Open

2		
3 4	24	exposure to screen-based media and social media platforms differed by socio-
5 6	25	demographic characteristics, and was higher among older adolescents than younger
7 8	26	adolescents.
9 10	27	Conclusions: The large percentages of adolescents across all countries who report
11 12 13	28	viewing screen-based media and social media usage, and high rates of self-reported
14 15	29	advertising exposure, support the need for policies to restrict marketing of unhealthy food
16 17	30	and beverages appealing to adolescents on screen-based media.
18 19	31	
20 21 22	32	Keywords: Food marketing; food policy; marketing to children; broadcast media; digital
22	52	Rey words. I ood marketing, food poney, marketing to enharen, oroudeast media, algitar
24 25	33	media; adolescents; food environment
26 27	34	
28 29	35	Article summary
30 31	36	Strenghts and limitations of this study
32 33 34	37	• The study has a large sample size, and employs the same measures across
35 36	38	countries, allowing justifiable comparisons between countries.
37 38	39	• Assessed self-reported exposure to a wide range of social media platforms, and
39 40	40	differentiated locations of self-reported exposure to screen-based advertisements.
41		
42 43 44	41	• Adolescents retrospectively self-reported the estimated screen time spent on each
45 46	42	media channel rather than using a more objective approach.
47 48	43	• Self-reported exposure to marketing may result in an underestimation of exposure
49 50	44	to marketing, and this study provides a conservative estimate.
51 52	45	• Time spent watching cable television vs. on streaming applications (Netflix,
53 54 55 56	46	Crave, Amazon Prime Video, etc.) was not distinguished in this study.
57 58 59 60		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

### BMJ Open

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,

- 67 10). Various marketing techniques are used across media channels to optimize the
- 68 effectiveness of marketing (8, 11-14), and may differ both in their impact on children and
- 69 adolescents as well as whether or not children and adolescents can recognize them as

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Page 7 of 49

1

# BMJ Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2	
3	
4	
5 6	
6	
/	
8 0	
9 10 11 12 13 14 15 16	
11	
12	
13	
14	
15	
13 14 15 16 17	
•••	
18 10	
19 20	
20 21	
22	
23	
24	
25 26	
26 27	
27 28	
20 29	
30	
31	
32	
33	
34	
35 36	
36	
37 38	
30 39	
40	
41	
42	
43	
44	
45	
46 47	
48	
49	
50	
51	
52	
53	
54	
55 56	
50 57	
58	
59	
60	

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

### **BMJ** Open

1 2		
2 3 4	92	Data are from the 2019 International Food Policy Study (IFPS) Youth Survey, an
5 6	93	annual repeat cross-sectional survey conducted in Australia, Canada, Chile, Mexico, the
7 8 9	94	UK and the USA. Data were collected via self-completed, web-based surveys conducted
10 11	95	in November-December 2019 with adolescents aged 10 to 17 years. According to the
12 13	96	World Health Organization (WHO), the period of adolescence is between 10 and 19 years
14 15	97	of age (26); participants will henceforth be referred to as younger adolescents (ages 10-
16 17 18	98	13) and older adolescents (14-17). Respondents were recruited through parents/guardians
19 20	99	enrolled in the Nielsen Consumer Insights Global Panel and their partners' panels. Email
21 22	100	invitations with unique survey links were sent to adult panelists within each country.
23 24	101	Those who confirmed they had a child aged 10 to 17 living in their household were asked
25 26 27	102	for permission for their child to complete the survey (only one child per household was
28 29	103	invited). Adolescents aged 10 to 17 years were eligible to participate, with quotas for age
30 31	104	and sex groups in the UK and USA. After eligibility screening, all potential respondents
32 33 34	105	were provided with information about the study and asked to provide assent. Surveys
35 36	106	were conducted in English in Australia and the UK; Spanish in Chile and Mexico;
37 38	107	English or French in Canada; and English or Spanish in the USA. Members of the
39 40	108	research team who were native in each language reviewed the French and Spanish
41 42 43	109	translations independently. The median survey time was 24 minutes.
44 45	110	The child's parent/guardian received remuneration in accordance with their panel's
46 47	111	usual incentive structure (e.g., points-based or monetary rewards, chances to win prizes).
48 49 50	112	A full description of the study methods can be found in the International Food Policy
50 51 52	113	Study: Technical Report – 2019 Youth Survey at http://foodpolicystudy.com/methods/
53 54	114	(27).
55 56 57		
5/		

59 60

58

#### BMJ Open

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,

# BMJ Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

1	
2	
3	
4	
5	
6	
7 8	
8 9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
22 23	
24	
24	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
42	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
50 59	
60	

	9
138	as might be expected. The maximum amount obtained using this method was compared
139	with a hypothetical estimation based on an assumption that on a weekday, children and
140	adolescents spend roughly 7 hours at school and 8 hours sleeping, which sums up to 15
141	hours. It is plausible that there may have been some screen time during school hours that
142	would fall within the aforementioned categories (browsing or watching YouTube), and so
143	it was assumed that this was approximately 1 hour. The total (14 hours) was subtracted
144	from the length of a day (24 hours) to give a possible maximum of 10 hours of screen
145	time, with a maximum of 20 hours if two screens were being used simultaneously. This
146	estimation of 20 hours (1200 minutes) confirms the measure of total maximal screen time
147	for weekdays (1195 minutes) and weekends (1268 minutes) has good face-validity.
148	2.2 Usage of social media platforms
149	Self-reported usage of various social media platforms was assessed using the
150	measure: "Do you use? (select all that apply)" (Response options: "Facebook",
151	"Instagram", "TikTok", "Twitter", "Snapchat", "none of the above", "don't know" or
152	"refuse to answer").
153	2.3 Self-reported location of exposure to unhealthy food and beverage
154	advertisements
155	Self-reported location of exposure to advertisements was assessed using the question:
156	"Have you seen or heard <u>advertisements for "unhealthy" foods or drinks</u> in any of these
157	places in the last 30 days?" Participants were instructed "Unhealthy food and drinks
158	include processed foods high in sugar, salt, or saturated fat, such as soda/pop, fast food,
159	chips, sugary cereals, cookies and chocolate bars." Participants could select all the
160	responses that applied from a list of 13 potential media channels, and an 'other' option

Page 11 of 49

#### BMJ Open

	161	with an open-text box, or "I haven't seen any ads for unhealthy food in the last 30 days",
	162	"don't know" or "refuse to answer." In this study, three channels were analyzed that
	163	pertain to screen-based media (television shows, series or movies; website or social
) I	164	media; and video or computer games). Open text data were reviewed, and responses were
<u>2</u> 3	165	re-coded to be included as one of the categorical options as applicable. "YouTube" and
1 5	166	"social media" were recoded to be included in the category "website or social media" and
5 7 3	167	"TV" was recoded in the category of television shows. When participants wrote "all" in
)	168	the open text, these responses were coded in each category of advertisement location.
1 2	169	2.4 Self-reported frequency of exposure to unhealthy food and beverage
3 4 5	170	advertisements
5 5 7	171	Self-reported frequency of exposure to unhealthy food and beverage advertisements
3 9	172	was assessed using the question: "In the last 30 days, how often did you see or hear
)   >	173	advertisements for these kinds of food or drinks?" Participants responded for
- 3 4	174	advertisements for six food categories, two of which were included in this analysis
5	175	(sugary drinks; fast food from a restaurant). The frequency was assessed using a likert-
7 3	176	type scale. (Response options: "never", "less than once a week", "once a week", "a few
) 	177	times a week", "everyday", "more than once a day", "don't know" and "refuse to
2 3	178	answer"). Frequency of exposure was then recoded as a binary variable, where
1	179	"everyday" and "more than once a day" were combined as "daily", and the other options
5 7 3	180	combined as "less than once a day"; responses of "don't know" or "refused" were
- )	181	considered as missing.
 <u>2</u>	182	2.5 Socio-demographic measures
3 1		

BMJ

183	Socio-demographic data included age, ethnicity, sex, country, school grades and
184	perceived income adequacy. Age was included as a binary variable (younger adolescents
185	aged 10 to 13 years, and older adolescents aged 14 to 17 years). Ethnicity was assessed
186	using unique measures from each country and recoded to derive comparable measures
187	across countries: majority or minority ethnicity. Participant's sex was self-reported by
188	asking "Are you " with responses "male" or "female". School grades were measured
189	using the question: "What grades do you usually get in school?" Response options varied
190	across countries and were recoded to derive comparable measures across countries and
191	three groups were created: "low" ( <grade "mid"="" (grade="" b="" countries),="" in="" in<="" most="" of="" td=""></grade>
192	most countries) or "high" grades (grade of A in most countries). Perceived income
193	adequacy was examined using the measure: "Does your family have enough money to pay
194	for things your family needs?" (Response options: "not enough money", "barely enough
195	money", "enough money", "more than enough money", "don't know" and "refuse to
196	answer"). Perceived income adequacy was recoded as a binary variable, (not enough
197	money/barely enough money were combined as "inadequate" and enough money/more
198	than enough money were combined as "adequate"); responses of "don't know" or
199	"refused" were considered as missing and excluded from analyses. Participant's body
200	mass index (BMI) was calculated using self-reported height and weight. BMI was
201	assessed using z-scores and classified according to the WHO recommendations (28).
202	Severe thinness, thinness and normal weight were combined considering low levels of
203	respondents for the severe thinness and thinness category (All countries = 2.9%,
204	Australia = 3.3%, Canada = 4.2%, Chile = 0.9%, Mexico = 1.7%, UK = 2.8%, US =
205	3.0%). Extreme values were recoded as missing (z-score $< -5$ or $> 5$ ) according to the

57 58 59

60

#### BMJ Open

1 2		
3 4	206	WHO growth reference guidelines (29). Extreme values as well as those participants
5 6	207	whose height and/or weight were missing were coded as "not reported" and included in
7 8 9	208	the analytic sample to reduce bias as potentially important differences between those who
9 10 11	209	do not report their height and weight in population-level surveys have been identified
12 13	210	(30). A full list of measures in each country is available at
14 15	211	http://foodpolicystudy.com/methods/ in the surveys section (31). The questionnaire has
16 17 18	212	not been validated, but cognitive testing among a subsample of English-speaking
19 20	213	adolescents for various questions including screen time and exposure to advertisements
21 22	214	has been conducted to verify their understanding. When necessary, questions were
23 24 25	215	adapted to improve comprehension (unpublished data).
25 26 27	216	2.6 Data analysis
28 29	217	A total of 11,491 adolescents completed the survey. Respondents were excluded for
30 31	218	the following reasons: region was missing, ineligible or had an inadequate sample size
32 33 34	219	(i.e., Canadian territories); invalid response to a data quality question; and/or survey
35 36	220	completion time under 10 minutes (n=383). The analytic sample included 11,108
37 38	221	respondents (Australia: n=1,435; Canada: n=3,682; Chile: n=1,252; Mexico: n=1,616;
39 40 41	222	UK: n=1,520; USA: n=1,603). A sub-sample (n=9,171) was included in the current
41 42 43	223	analysis after excluding respondents with missing data (including don't know and refuse
44 45	224	to answer) for social media usage, screen time, location and frequency of exposure to
46 47	225	unhealthy food and beverage advertisements, ethnicity, school grades and perceived
48 49 50	226	income adequacy (Supplementary Figure S1). Data were weighted with post-
51 52	227	stratification sample weights constructed using a raking algorithm with population
53 54		
55		
56 57		

Page 14 of 49

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

#### **BMJ** Open

estimates from the census in each country based on age group, sex, region, and ethnicity
(except in Canada). Reported estimates are weighted.
Descriptive statistics were tabulated including the self-reported mean number of

hours viewing screen-based media across all channels and by channel on a weekday and
weekend day, the self-reported usage of each social media platform and mean number of
social media platforms (maximum of 5 platforms), the self-reported frequency of the
three advertisement locations and the percentage of respondents reporting being exposed
daily to advertisements for sugary drinks and fast food by country.

Regression models examined differences in the amount of self-reported exposure to
screen-based media between countries and population subgroups. First, linear regressions
were conducted with the amount of self-reported exposure to screen-based media (total
screen time in minutes) as the dependent variable, including an indicator variable for
country and age category (10-13 years, 14-17 years), adjusting for sex, ethnicity,
perceived income adequacy, school grades, and BMI. Next, separate logistic regression

models were conducted for each social media type (1=yes, 0=no), including an indicator variable for country and age category, and adjusting for the same variables listed above. Lastly, separate logistic regression analyses were used to examine associations between the self-reported exposure to screen-based media and self-reported daily exposure to advertisements for each of the food categories (sugary drinks; fast food from a restaurant), with self-reported daily exposure to sugary drink or fast food marketing as the dependent variable, including indicator variables for the amount of exposure on a weekday (continuous) and country, adjusting for the same demographic correlates. Separate models were tested for self-reported exposure to screen-based media on

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

## BMJ Open

2		
3 4	251	weekends. For all regressions, survey-aware procedures were used to account for finite
5	252	sampling methods, and 99% confidence intervals are presented due to the use of multiple
6 7	232	sampling methods, and 3376 confidence mervals are presented due to the use of multiple
8 9	253	comparisons. Analyses were conducted using SAS Studio 3.8.
10 11	254	2.7 Patient and public involvement
12 13	255	Patients and the public were not involved in the design, conduct, analysis or
14 15 16	256	interpretation of the study. Study participants could have access to the study results upon
17 18	257	request.
19 20	258	3. Results
21 22	259	Weighted sample characteristics are presented in Table 1. There were differences
23 24 25	260	between countries in ethnicity group, school grades, perceived income adequacy and
26 27	261	BMI. In general, a greater percentage of participants identified as a minority group in the
28 29	262	USA, a smaller percentage had high school grades in Australia and the UK, and a greater
30 31 32	263	percentage perceived their family income as adequate in Canada.
32 33 34	264	3.1 Self-reported exposure to screen-based media
35 36	265	Figure 1 shows the mean amount of total self-reported screen time for a weekday
37 38	266	among participants across countries, which ranged from 7.6 hours (Canada and Australia)
39 40 41	267	to 10.2 hours (Chile). Similar findings were observed across countries for a weekend day,
42 43	268	but with higher total amounts (Supplementary Figure S2). Time spent on various media
44 45	269	channels is shown in Supplementary Figure S3. Digital media, comprised of YouTube,
46 47 48	270	social media and browsing, reading websites and Googling, was the largest contributor
49 50	271	overall. Across all countries, participants in Chile spent the highest amount of time on
51 52	272	YouTube, social media, playing games and browsing, while participants in the USA spent
53 54	273	the most time watching television on a weekday.
55 56 57		

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2	
3	
4	
5	
6	
7	
8	
9	
10	
12 13 14 15	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
55	
54 55	
56	
57	
58	
59	
60	

1

h

274 Estimates from a linear regression model examining the total amount of self-reported 275 exposure to screen-based media on a weekday across countries is shown in Table 2. Total 276 screen time differed by country, and across all demographic correlates. Participants in 277 Canada and Australia reported less screen time than those in Chile, Mexico and USA; and 278 Chilean participants reported more screen time than those in all other countries except 279 Mexico. Older adolescents spent more time on screens than younger adolescents. The 280 same pattern of results was observed for a weekend day (Supplementary Table S1). 281 3.2 Self-reported social media exposure

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

Estimates from separate logistic regression models examining self-reported exposure to social media platforms across countries are shown in **Table 3** and differed by country Page 17 of 49

#### **BMJ** Open

2		
3 4	297	and age group for all platforms. Specifically, participants in Canada were less likely to
5 6	298	use Facebook than those in all other countries, whereas participants in Mexico were more
7 8 9	299	likely to use Facebook than those in all other countries. Those in Chile were more likely
10 11	300	to use Instagram than those in all other countries. Participants from Canada were more
12 13	301	likely to use TikTok than participants in Australia, Chile, Mexico and the UK.
14 15	302	Participants in Mexico were more likely to use Twitter than participants in all other
16 17 18	303	countries, and those in the UK were more likely to use Snapchat than those in all other
19 20	304	countries except the USA. Participants in Australia were more likely to not use a social
21 22	305	media platform compared to all other countries except the USA. Older adolescents (ages
23 24	306	14-17) were more likely to use all social media platforms except TikTok compared to
25 26 27	307	younger adolescents (ages 10-13).
28 29	308	3.3 Location of self-reported screen-based exposure to advertisements for unhealthy
30 31	309	foods or drinks
32 33 34	310	The percentage of adolescents who reported that they were exposed to advertisements
35 36	311	for unhealthy foods or drinks in three locations in the previous 30 days is shown in
37 38		
	312	Figure 3. Overall, TV shows, series or movies accounted for the largest number of
39 40	<ul><li>312</li><li>313</li></ul>	<b>Figure 3</b> . Overall, TV shows, series or movies accounted for the largest number of participants self-reporting exposure to advertisements (range: from 43% in the UK to
40 41 42		
40 41	313	participants self-reporting exposure to advertisements (range: from 43% in the UK to
40 41 42 43 44 45 46 47	313 314	participants self-reporting exposure to advertisements (range: from 43% in the UK to 69% in Mexico and Chile), followed by websites or social media (range: from 27% in the
40 41 42 43 44 45 46 47 48 49	<ul><li>313</li><li>314</li><li>315</li></ul>	participants self-reporting exposure to advertisements (range: from 43% in the UK to 69% in Mexico and Chile), followed by websites or social media (range: from 27% in the UK to 60% in Chile), and video or computer games (range: from 10% in Australia and
40 41 42 43 44 45 46 47 48 49 50 51	<ul><li>313</li><li>314</li><li>315</li><li>316</li></ul>	participants self-reporting exposure to advertisements (range: from 43% in the UK to 69% in Mexico and Chile), followed by websites or social media (range: from 27% in the UK to 60% in Chile), and video or computer games (range: from 10% in Australia and the UK to 17% in Chile).
40 41 42 43 44 45 46 47 48 49 50	<ul> <li>313</li> <li>314</li> <li>315</li> <li>316</li> <li>317</li> </ul>	<ul> <li>participants self-reporting exposure to advertisements (range: from 43% in the UK to 69% in Mexico and Chile), followed by websites or social media (range: from 27% in the UK to 60% in Chile), and video or computer games (range: from 10% in Australia and the UK to 17% in Chile).</li> <li>3.4 Self-reported daily exposure to sugary beverage and fast food advertisements</li> </ul>

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

reported daily exposure to sugary drinks advertisements ranged from 10% (UK) to 43%
(Mexico). Self-reported daily exposure to fast food advertisements was relatively more
consistent across countries, with the exception of the UK (range: from 19% in the UK to
44% in the USA).

Estimates from separate logistic regression models examining self-reported daily exposure to sugary beverage and fast food advertisements across countries are shown in 
 Table 4. Participants who self-reported more time spent on screen-based media were
 more likely to report daily exposure to advertisements for both food categories. Self-reported daily exposure to advertisements for sugary drinks and fast food differed by country and amount of self-reported exposure to screen-based media (total screen time in minutes), and patterns were mostly similar across both food categories; there was no significant difference in self-reported exposure between age groups. Overall, participants in Mexico and Chile were much more likely to report daily exposure to sugary beverage advertisements than participants in all other countries, with fewer differences for fast food advertisements. Participants in the UK were less likely to report daily exposure to advertisements of sugary drinks and fast food compared to all other countries and those in the USA were more likely to report daily exposure to fast food advertisements than those in all other countries. The same pattern of results was observed for exposure to screen based media on a weekend day (Supplementary Table S2).

339 4. Discussion

340 Summary of main findings

341 This study found that adolescents across Australia, Canada, Chile, Mexico, UK and
342 USA are self-reporting considerable amounts of time viewing screen-based media,

Page 19 of 49

#### **BMJ** Open

although these self-reported estimates include simultaneous viewing of multiple media. Digital media accounted for the most time on screens and social media use varied by platforms. Across all countries, self-reported exposure to advertisements in the past 30 days was most frequent on television, followed by digital media and gaming platforms. Between-country differences were identified: participants in the UK reported less daily exposure to fast food and sugary drinks advertisements, whereas participants in the USA reported greater daily exposure to fast food advertisements. Most importantly, our results show that in all countries, self-reported exposure to advertisements increased with greater screen time. Analyses suggested important differences in self-reported exposure to screen-based media and social media platforms between age groups, with older adolescents generally reporting a greater exposure. **Relationships with existing knowledge** The estimates from this study are similar to other international estimates of self-reported screen time. In the US, screen time among children 8-12 years in 2019 was estimated to be 4 hours 44 minutes, and 7 hours and 22 minutes among 13-18 year olds (32), compared to over 9 hours in the current study among the older age group. A large national Canadian study from 2013-2014 suggests that youth ages 13 to 18 spent on average between 7.6 and 8 hours in front of screens daily (depending on province and sex) (33), very similar to the current findings of approximately 8.5 hours among older adolescents. However, the current estimates appear to be higher than several European estimates from various countries (34), which may be due to differences in the types of questions asked and the study context that may affect recall and self-report. Even with limitations on the precision of screentime estimates due to self-report, most participants 

#### **BMJ** Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2	
3	
4	
5	
6	
5 6 7	
8	
9	
10	
11	
12	
12	
13	
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	
15	
16	
17	
18	
19	
20	
21	
22	
22	
23	
24	
22 23 24 25 26 27	
26	
27 28 29 30	
28	
29	
30	
31	
22	
32 33	
22	
34	
<ul> <li>33</li> <li>34</li> <li>35</li> <li>36</li> <li>37</li> <li>38</li> </ul>	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
52	
22	
54	
55	
56	
57	
58	
59	
60	

1

2

in the current study exceeded screen time guidelines across countries, which recommend
entertainment screen time be limited to less than 2 hours daily for school-aged children
and adolescents (35-37). Screen time has previously been associated with youth obesity
(38, 39), poorer diet quality (40), and consumption of less healthy foods and beverages
(41, 42). The general level of exposure reported among the sample, while an
approximation, is cause for concern.

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

Page 21 of 49

#### **BMJ** Open

2		
3 4	388	In this study, a greater proportion of adolescents reported exposure to advertisements
5 6	389	for unhealthy foods or drinks on television compared to websites, social media
7 8 9	390	applications or gaming sites. Greater reporting may be in part due to the different types of
9 10 11	391	advertising between these channels. In order for children and adolescents to be aware of
12 13	392	advertisements, they need to be able to identify the difference between an advertisement
14 15 16	393	and other content, but also understand the persuasive intent behind the message (15).
17 18	394	Self-reported exposure to advertisements on television may have been higher as it is more
19 20	395	easily identifiable compared to digital marketing which often uses subtle marketing
21 22 23	396	techniques (e.g. such as celebrity endorsements by influencers and native advertising
24 25	397	designed to imitate editorial content) and is frequently disguised as entertainment (15,
26 27	398	16). On digital media, adolescents may simply be less able to discriminate advertisements
28 29 30	399	from other content, making marketing on these channels particularly alarming. Digital
31 32	400	marketing via advertisements is typically targeted, using cookies and other means which
33 34	401	record personal preferences, online activity, and location and these data are then used to
35 36 27	402	personalize and target the content of marketing to individual users, therefore increasing
37 38 39	403	the persuasive power of marketing (10, 11). The subtle advertising techniques used on
40 41	404	digital media, such as influencer endorsements or advergames may be more likely to
42 43	405	bypass children's and younger adolescents' cognitive awareness. Our data align with
44 45 46	406	marketing expenditure data, an objective indicator of marketing efforts by companies:
40 47 48	407	fast-food advertisement expenditures are the highest for television, although digital
49 50	408	marketing expenditures increased by 74% between 2012 and 2019 (45). However, digital
51 52	409	marketing expenditures are likely underestimated as not all industry spending can be
53 54 55 56	410	captured and spending is not necessarily associated with the reach of the message on

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

411 digital media (46). Therefore, both self-reported exposure data and the general digital
412 marketing expenditure data likely underestimate the amount of digital marketing to which
413 adolescents are currently exposed.

Self-reported daily exposure to advertisements was common for both fast food and sugary drinks, with 34% and 25% of the sample reporting daily exposure, respectively, in all countries. Perhaps unsurprisingly, those reporting more screen time were more likely to report daily exposure to sugary drinks and fast food advertisements. Differences across countries may in part relate to differences in restrictions on marketing directed at children. In the UK, where participants were less likely to self-report daily exposure to advertisements for fast food and sugary drinks than those in all other countries, a total ban of advertisements for unhealthy foods and beverages has been in place since 2007 during and adjacent to television programs appealing to children and adolescents under the age of 16 (47). The lower likelihood of self-reported exposure to advertisements aligns with what would be expected with the UK's current policy in place, although evidence on the impact of the UK policy is mixed. Findings suggest that despite some changes in children's exposure, advertisements typically shifted to other media channels, implying important loopholes in regulations (48, 49). In the USA, where participants were more likely to report daily exposure to fast food advertisements than those in all other countries, voluntary self-regulatory approaches to restrict marketing by the industry are the only form of marketing restrictions, which target children under 12 years of age on media where the audience is mostly children (50), and have largely proven ineffective at decreasing children's exposure to marketing for unhealthy products (45, 51, 52). It is important to note that the present study cannot capture the effectiveness of restrictive

Page 23 of 49

#### **BMJ** Open

2		
3 4	434	marketing policies by its cross-sectional design, but studying trends in self-reported
5 6	435	screen-time, social media use and exposure to advertisements annually over time using
7 8	436	the IFPS should help evaluate the impact of impending policies, such as the recently
9 10 11	437	announced policy in the UK which will ban online advertising by the end of 2022 and
12 13	438	ban advertising of foods high in fat, sugar and salt between 5:30 am and 9 pm (53-55).
14 15	439	Age group was an important predictor for reported screen-based media and social
16 17	440	media exposure, with older adolescents reporting spending more time on screens and
18 19 20	441	using social media platforms more than younger adolescents. Older adolescents may be
21 22	442	an age group of particular interest to marketers because of their greater spending power
23 24	443	compared to younger adolescents, which also increases with age, therefore having the
25 26 27	444	potential to create life-long brand relationships and product consumers (56, 57).
28 29	445	Marketers target adolescents through digital media by using "ubiquitous connectivity,
30 31	446	personalization, peer-to-peer networking, engagement, immersion and content creation",
32 33 34	447	which are features especially appealing to this age group (57). In our study, there were no
35 36	448	differences in self-reported daily exposure to sugary drink and fast food advertisements
37 38	449	between age groups. Despite adolescents having an improved ability to recognize
39 40	450	advertisement content and the persuasive intent of marketing compared to children,
41 42 43	451	adolescents may be even more vulnerable to digital food marketing, because of their
44 45	452	increased use of these platforms as well as desire to conform with social norms in their
46 47	453	peer group (58, 59). Greater exposure to digital and social media platforms may also
48 49	454	increase the number of subtle marketing strategies, for example viral marketing (peer-to-
50 51 52	455	peer), contests, quizzes and marketing by influencers, which may not be captured in self-
53 54 55	456	report measures if the participant is unable to identify these as marketing strategies.
56		

### **BMJ** Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool .

Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies

# **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,

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Page 25 of 49

#### **BMJ** Open

2		
3 4	480	Crave, Amazon Prime Video, etc.) was not distinguished in this study. The amount of
5 6	481	marketing exposure on cable television and free streaming websites compared to
7 8	482	subscription platforms (that are typically ad-free) is likely very different, and this may
9 10 11	483	play an important role in understanding the amount of exposure. Additionally,
12 13	484	adolescents retrospectively self-reported the estimated screen time spent on each media
14 15	485	channel rather than using a more objective approach, and this may have been influenced
16 17	486	by whether or not a parent was present when completing the survey. This approach has
18 19 20	487	not yet been validated in the literature, but nevertheless seems comparable to self-report
20 21 22	488	estimates from other surveys. Responses may not be precisely accurate, and likely
23 24	489	overestimate the absolute amount of screen time reported by youth as overall exposure
25 26	490	was calculated by summing self-reported exposure to individual media channels and thus
27 28 29	491	may include simultaneous use of multiple screens. Indicators of simultaneous viewing of
29 30 31	492	screens were not directly measured in the survey. Nevertheless, this tool allows for
32 33	493	comparisons of the relative amount of exposure across countries, as it is likely that the
34 35	494	challenge of estimations, and associated error, would be similar across countries. Lastly,
36 37	495	the measures did not distinguish between recreational screen time and screen time that
38 39 40	495	
40 41 42		was spent for school purposes (e.g., on websites).
43 44	497	4.2 Policy implications
45 46	498	These results reinforce the need to implement restrictive policies on marketing of

unhealthy food and beverages appealing to a young audience, not only on television but also on digital media considering the widespread self-reported usage of social media platforms among adolescents across countries and the persuasiveness of marketing that is often targeted. Future research examining children's and adolescents' exposure to digital

## BMJ Open

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
25	
24	
25	
26	
27	
28	
20	
29	
30	
31	
32	
33	
22	
34	
35	
36	
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	

503	marketing, as well as research modelling of the impact of potential policy measures, are
504	likely to be important in making the case for restricting less healthy food and beverage
505	content via these channels (62). This study also demonstrated the variety of media
506	channels that are being used by adolescents, even though their content may not be 'child-
507	targeted'(63) (i.e., social media, websites, etc.) but are indeed 'child appealing'(62, 64).
508	Almost all social media platforms (such as Instagram, Facebook and Snapchat) have a
509	minimum age of 13 to register (65-67), but previous research has suggested that nearly a
510	quarter of children aged 8 to 11 years have an account (68), demonstrating that self-
511	imposed age-restrictions are not effective. Our results were similar, with the younger
512	adolescents (10-13 years) self-reporting widespread usage of social media platforms. The
513	high rates of social media usage and self-reported exposure to advertisements via this
514	medium further demonstrates the need for restrictions to limit exposure to this vulnerable
515	age group.
516	The results of this study will be useful for future research as a baseline for comparison
517	with exposure to less healthy food marketing after the implementation of marketing
518	policies, but also in comparing adolescents' exposure to screen-based media and
519	marketing after important worldwide events leading to possible changes in media
520	consumption habits, such as changes in exposure as a result of the COVID-19 pandemic
521	(69).
522	
523	
524	
525	

BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2		
3 4	526	Ethics statement
5 6	527	The study was reviewed by and received ethics clearance through a University of
7 8 9	528	Waterloo Research Ethics Committee (ORE# 41477) and Laval University Ethics
) 10 11	529	Committee (#2021-318). All participants provided informed consent to take part.
12 13	530	
14 15 16	531	Contributorship statement
17 18	532	LV, CMW and DH designed research; CMW conducted research; EDP analyzed data and
19 20	533	wrote the paper; LV had primary responsibility for final content; MW, MPK, DH, CN,
21 22 23	534	CMW, XZ and LV reviewed and edited the manuscript. All authors read and approved
24 25	535	the final manuscript.
26 27	536	
28 29 30	537	Competing interests None declared. Funding
31 32	538	None declared.
33 34	539	
35 36 37	540	Funding
38 39	541	This work was supported by the Public Health Agency of Canada (PHAC, no grant
40 41	542	number available), with additional support from a Canadian Institutes of Health Research
42 43 44	543	(CIHR) Project Grant (PJT-162167).
45 46	544	
47 48	545	Data availability statement
49 50	546	Data are available upon reasonable request. Data are available directly from the
51 52 53	547	International Food Policy Study team on reasonable request (see
54 55 56 57	548	www.foodpolicystudy.com).
58 59 60		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

## 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: <u>https://doi.org/10.1086/209559</u>.
- 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.
- 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.

2 3

4

5

6 7

8

9

10

11

12 13

14

15

16

17

18 19

20

21

22

23 24

25

26

27

28

29 30

31

32

33

34 35

36

37

38

39

40 41

42

43

44

45 46

47

48

49

50

51 52

53

54

### **BMJ** Open

Smith R, Kelly B, Yeatman H, Moore C, Baur L, King L, Boyland E, Chapman K, 14. 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. Goerg GM, Best, C., Shobowale, S., Koehler, J., Remy, N. Advertising on YouTube 17. 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/seconddecade/section2/page1/recognizing-adolescence.html. Hammond D, White, C.M., Rynard, V.L., Vanderlee, L. International Food Policy 27. Study: Technical Report - 2019 Youth Survey. University of Waterloo. 2021. World Health Organization. BMI-for-age (5-19 years). 2021. 28. 29. World Health Organization. WHO AnthroPlus for Personal Computers Manual : Software for assessing growth of the world's children and adolescents. 2009. Read SH, Lewis SC, Halbesma N, Wild SH. Measuring the Association Between Body 30. Mass Index and All-Cause Mortality in the Presence of Missing Data: Analyses

2 3

4

5

6 7

8

9

10

11

12 13

14

15

16

17

18 19

20

21

22

23 24

25

26

27

28

29 30

31

32

33

34 35

36

37

38

39

40 41

42

43

44

45 46

47

48

49

50

51 52

53

54

60

From the Scottish National Diabetes Register. Am J Epidemiol 2017;185(8):641-9. doi: 10.1093/aje/kww162. 31. Hammond D. International Food Policy Study : 2019 Youth Survey - Canada. University of Waterloo. February 2021. 32. Rideout V, Robb, M.B. The common sense census: Media use by tweens and teens, 2019. In: Media CS, ed. San Francisco, CA, 2019. 33. 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. European Commission. Directorate-General for Health and Food Safety. Study on 34. the exposure of children to linear, non-linear and online marketing of foods high in fat, salt or sugar : final report. 2021. 35. American Academy of Pediatrics. Children, Adolescents, and the Media. Pediatrics 2013;132(5):958-61. doi: 10.1542/peds.2013-2656. 36. Canadian 24-Hour Movement Guidelines for Children and Youth. An Integration of Physical Activity, Sedentary Behaviour, and Sleep. 2021. Sociedad Chilena de Pediatria. Ninos y dispositivos electronicos: lo bueno y lo malo 37. de una exposicion inevitable. 2015. Lissak G. Adverse physiological and psychological effects of screen time on 38. children and adolescents: Literature review and case study. Environ Res 2018;164:149-57. doi: 10.1016/j.envres.2018.01.015. 39. 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. 40. 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. 41. 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. Andreyeva T, Kelly IR, Harris JL. Exposure to food advertising on television: 42. 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. 43. 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. 44. 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. Harris JL, Fleming-Milici, F., Phaneuf, L., Jensen, M., Choi, Y. Y., McCann, M., 45. Mancini, S. Fast food advertising : Billions in spending, continued high exposure by youth. Rudd Center for Food Policy and Obesity 2021. For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

2 3

4

5

6 7

8

9

10

11

12 13

14

15

16

17

18 19

20

21

22

23 24

25

26

27

28

29 30

31

32

33

34 35

36

37

38

39

40 41

42

43

44

45 46

47

48

49

50

51 52

53

54

60

### **BMJ** Open

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. Boyland EJ, Harrold JA, Kirkham TC, Halford JCG. The extent of food advertising to 48. 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: PLoS ONE Repeat **Cross-Sectional** Study. 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. Adams J, Tyrrell R, Adamson AJ, White M. Socio-economic differences in exposure 55. 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. Brownell KD, Schwartz MB, Puhl RM, Henderson KE, Harris JL. The need for bold 56. 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. Harris JL, Yokum S, Fleming-Milici F. Hooked on Junk: Emerging Evidence on How 59. Food Marketing Affects Adolescents' Diets and Long-Term Health. Current Addiction Reports 2021;8(1):19-27. doi: 10.1007/s40429-020-00346-4.

- 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: <u>https://www.snap.com/en-US/terms</u> (accessed 3 October 2021).
- 66. Instagram. Internet: <u>https://help.instagram.com/581066165581870#</u> (accessed 3 October 2021).
- 67. Facebook. Internet: <u>https://www.facebook.com/help/157793540954833/</u> (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.

Page 33 of 49			BMJ Open			10.1136/bmjope cted by copyrig		
1 <b>TABL</b>	JES					omjope opyriç		
2 3 4 5 6	Table 1. Sample characteristics of adolescent	nts in six countr	ies (weighted	d) N = 9171.		10.1136/bmjopen-2021-0589 .cted by copyright, including		
7 8 9	Characteristic	All countries (n=9171)	Australia (n=1127)	Canada (n=2869)	Chile (n=1124)	Mæticg (n=505)	UK (n=1140)	USA (n=1406)
10					% (n)	s s		
11 12	Age (years)	50 (4551)		50 (1420)	47 (52.4)	lay 2022 Erasmu 50 tt	40 (5(0)	10 ((02))
13	10-13	50 (4551)	51 (574)	50 (1438)	47 (534)		49 (562)	49 (693)
14	14-17	50 (4620)	49 (553)	50 (1431)	53 (590)		51 (578)	51 (713)
15	Sex		52(502)	50 (1440)	(570)	c1 and with	<i>51 (5</i> 01)	51 (700)
16 17	Male	51 (4664)	52 (582)	50 (1446)	51 (572)		51 (581)	51 (722)
18	Female	49 (4507)	48 (545)	50 (1423)	49 (552)	49 (ata	49 (559)	49 (684)
19	Ethnicity Majority group	76 (6076)	75 (950)	72(2000)	95 (059)	78 ( <u>1</u> 76)	92(041)	(9, (050))
20	Majority group	76 (6976)	75 (850)	73 (2098)	85 (958)		83 (941)	68 (959) 22 (447)
21	Minority group	24 (2195)	25 (277)	27 (771)	15 (166)	22 @35	17 (199)	32 (447)
22 23	School grades Low	16 (1461)	32 (365)	13 (373)	6 (65)	7 (	29 (334)	16 (223)
4	Mid	38 (3508)	38 (430)	34 (974)	49 (555)	36 (5) 49	38 (430)	41 (570)
25	High	46 (4202)	29 (332)	53 (1522)	49 (555) 45 (505)		33 (375)	44 (613)
6 7	Perceived Income Adequacy	40 (4202)	27 (332)	33 (1322)	43 (303)	57 (255)	55 (575)	44 (013)
3	Inadequate	24 (2222)	25 (283)	17 (488)	31 (345)	28 🗃 18	26 (291)	28 (397)
)	Adequate	76 (6949)	75 (844)	83 (2381)	69 (779)	72 ( <b>1</b> 08 <b>2</b> )	74 (849)	72 (1009)
0	Self-reported BMI	70 (0717)	13 (011)	05 (2501)	05 (115)		/ 1 (01)	72 (1005)
1	Severe thinness/thinness/normal weight	49 (4480)	45 (509)	57 (1630)	43 (478)	48 (177) 48 (177)	41 (462)	49 (683)
32 3	Overweight	18 (1665)	16 (176)	16 (473)	21 (231)		13 (147)	22 (304)
4	Obesity	10 (927)	10 (113)	9 (255)	9 (97)	10 ( <b>#</b> 48 <b>)</b>	8 (92)	16 (222)
35	Not reported	23 (2100)	29 (328)	18 (511)	28 (319)	20 (306)	39 (439)	14 (197)
36 37 38 39 40 41 42 43						Department GEZ-LTA		

Female vs. male	Wald χ <sup>2</sup> 64.2 25.3	B (CI)           -18.1 (-47.2,11.0)           -170.2 (-205.8,-134.5)           -144.3 (-179.3,-109.3)           -26.8 (-60.7,7.2)           -107.8 (-142.6,-72.9)           -152.1 (-181.9,-122.3)           -126.2 (-154.9,-97.5)           -8.7 (-37.7,20.3)           -89.7 (-118.2,-61.1)           25.8 (-9.1,60.8)           143.4 (107.9,178.9)           62.4 (26.7,98.0)           117.6 (82.7,152.4)           36.5 (1.9,71.2)           -81.0 (-116.1,-45.9)
AUS vs. CAN AUS vs. CHILE AUS vs. MEX AUS vs. UK AUS vs. USA CAN vs. USA CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. USA MEX vs. UK MEX vs. USA UK vs. USA Sex Female vs. male	64.2	-18.1 (-47.2,11.0) -170.2 (-205.8,-134.5) -144.3 (-179.3,-109.3) -26.8 (-60.7,7.2) -107.8 (-142.6,-72.9) -152.1 (-181.9,-122.3) -126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
AUS vs. CHILE AUS vs. MEX AUS vs. UK AUS vs. USA CAN vs. USA CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA Sex Female vs. male		-170.2 (-205.8,-134.5) -144.3 (-179.3,-109.3) -26.8 (-60.7,7.2) -107.8 (-142.6,-72.9) -152.1 (-181.9,-122.3) -126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
AUS vs. MEX AUS vs. UK AUS vs. UK AUS vs. USA CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. UK MEX vs. USA MEX vs. USA UK vs. USA Sex Female vs. male		-144.3 (-179.3,-109.3) -26.8 (-60.7,7.2) -107.8 (-142.6,-72.9) -152.1 (-181.9,-122.3) -126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
AUS vs. UK AUS vs. USA CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA Sex Female vs. male		-144.3 (-179.3,-109.3) -26.8 (-60.7,7.2) -107.8 (-142.6,-72.9) -152.1 (-181.9,-122.3) -126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
AUS vs. USA CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA UK vs. USA Sex Female vs. male		-26.8 (-60.7,7.2) -107.8 (-142.6,-72.9) -152.1 (-181.9,-122.3) -126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA Sex Female vs. male		-107.8 (-142.6,-72.9) -152.1 (-181.9,-122.3) -126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CAN vs. CHILE CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA Sex Female vs. male		-152.1 (-181.9,-122.3) -126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CAN vs. MEX CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. UK MEX vs. USA MEX vs. USA UK vs. USA Sex Female vs. male		-126.2 (-154.9,-97.5) -8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CAN vs. UK CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA UK vs. USA Sex Female vs. male		-8.7 (-37.7,20.3) -89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. USA MEX vs. USA MEX vs. USA UK vs. USA Sex		-89.7 (-118.2,-61.1) 25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CHILE vs. MEX CHILE vs. UK CHILE vs. USA MEX vs. UK MEX vs. USA UK vs. USA Sex Female vs. male		25.8 (-9.1,60.8) 143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CHILE vs. UK CHILE vs. USA MEX vs. UK MEX vs. USA UK vs. USA Sex Female vs. male		143.4 (107.9,178.9) 62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
CHILE vs. USA MEX vs. UK MEX vs. USA UK vs. USA Sex Female vs. male		62.4 (26.7,98.0) 117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
MEX vs. UK MEX vs. USA UK vs. USA Sex Female vs. male		117.6 (82.7,152.4) 36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
MEX vs. USA UK vs. USA Sex Female vs. male		36.5 (1.9,71.2) -81.0 (-116.1,-45.9)
UK vs. USA Sex Female vs. male		-81.0 (-116.1,-45.9)
Sex Female vs. male		
Female vs. male		247(524160)
	200.4	
Age		-34.7 (-52.4,-16.9)
10.12 years vs. $14.17$ years	209.4	00.7(117.4, 91.0)
10-13 years vs. 14-17 years	18.5	-99.7 (-117.4,-81.9)
Ethnicity Maintenant minority	18.5	200((22)15())
Majority vs. minority	1(0)	-38.9 (-62.2,-15.6)
Perceived income adequacy	16.0	220(542,110)
Adequate vs. inadequate	10.0	-33.0 (-54.3,-11.8)
School grades	19.9	
High vs. low		-64.0 (-90.7,-37.2)
High vs. mid		-26.6 (-46.2,-7.0)
Low vs. mid	1.6.0	37.4 (10.6,64.1)
BMI	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.		
<b>Notes</b> : The variable listed second is the reference variable.		
Abbreviations: AUS=Australia, CAN=Canada, MEX=Mexico, U	UK=Unite	ed Kingdom, USA=Ui
States of America; B=Beta; CI = 99% confidence interval.		

**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).

## **BMJ** Open

				-		forms among adolesc			ici er			
Parameter		re to Facebook		are to Instagram		are to TikTok		re to Twitter	Expost Wald	re to Snapchat Odds ratio (CI)		sure to social r
Country	<u>wald <u>x</u> 81.7</u>	<sup>2</sup> Odds ratio (CI)	<u></u> 17.6	2 <sup>2</sup> Odds ratio (CI)	<u>waid χ</u> 15.2	<sup>2</sup> Odds ratio (CI)	28.4	<sup>2</sup> Odds ratio (CI)	L 22	L	Wald χ <sup>2</sup> 10.0	Odds ratio
Country AUS vs. CAN	01.7	1.28 (1.04,1.56)	17.0	0.90 (0.73,1.11)	13.2	0.80 (0.64,1.00)	20.4	0.92 (0.70,1.20)	cfluding fo	0.77 (0.63,0.95)	10.0	1.29 (1.01,
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)	lini	1.96 (1.50,2.56)		1.72 (1.25,
AUS vs. MEX		0.23 (0.18,0.30)		0.95 (0.74,1.21)		1.54 (1.15,2.04)		0.72 (0.32,0.99)	91	1.57 (1.22,2.03)		2.18 (1.57,
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)				1.59 (1.16.
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)	or u	0.73 (0.57,0.92)		1.19 (0.89,
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)	uses			1.33 (1.01,
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)	S Z			1.69 (1.27,
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)	May Er s rela	0.80 (0.65,0.98)		1.23 (0.93,
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)	ate	<b>0.80</b> (0.03,0.98) <b>0.94</b> (0.78,1.13)		0.92 (0.72,
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)	rasmu ated t	0.80 (0.61,1.05)		1.27 (0.91)
CHILE VS. WEX		1.10(0.85, 1.42)		1.90 (1.32,2.19)		0.74 (0.56,0.98)		0.75 (0.56,1.01)	다 린 N	0.21 (0.24 0.41)		0.92 (0.66,
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)	iz. Dow nushou to text	0.37 (0.29,0.48)		0.69 (0.51.
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)	× č č	0.39 (0.30,0.51)		0.09 (0.51,
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)	oge:	0.39 (0.30,0.51)		0.75 (0.31,
		0.94 (0.74,1.20)							a	1.18(0.02, 1.50)		
UK vs. USA Sex	0.6	0.94 (0.74,1.20)	69.7	1.29 (1.01,1.66)	250.4	0.81 (0.63,1.05)	1.9	1.11 (0.83,1.46)	ဗီးဝို့ဗိ	1.18 (0.93,1.50)	85.3	0.75 (0.54
Female vs. male	0.0	1.04 (0.02.1.19)	09.7	1.50 (1.33,1.71)	230.4	2 21 (2 02 2 65)	1.9	0.92 (0.80,1.07)	ి <del>చ</del> ిత్రాంత	1 97 (1 65 2 12)	83.5	0.55 (0.47,
	601.2	1.04 (0.92,1.18)	705.2	1.50 (1.55,1.71)	30.1	2.31 (2.02,2.65)	380.7	0.92 (0.80,1.07)		1.87 (1.65,2.12)	588.0	0.33 (0.47
Age	001.2	0.20 (0.26 0.24)	703.2	0.27 (0.24.0.20)	50.1	1.24(1.17.1.54)	580.7	0.21 (0.27.0.26)	<b>3</b> ,0.40	0.27 (0.22 0.42)	388.0	6 24 (5 14
10-13 years vs. 14-17 years Ethnicity	0.4	0.30 (0.26,0.34)	1.5	0.27 (0.24,0.30)	0.0	1.34 (1.17,1.54)	2.3	0.31 (0.27,0.36)	and data mining, Atr	0.37 (0.32,0.42)	1.1	6.24 (5.14,
5	0.4	0.07 (0.02.1.12)	1.5	0.02 (0.70.1.00)	0.0	1.01 (0.05.1.20)	2.3	0.00 (0.74.1.00)	_@∠ <mark>∃</mark>	0.07 (0.02.1.14)	1.1	1 00 (0 00
Majority vs. minority	(1	0.96 (0.82,1.13)	26	0.93 (0.79,1.09)	1.3	1.01 (0.85,1.20)	7 (	0.90 (0.74,1.08)	A4trai®ing,	0.97 (0.83,1.14)	0.1	1.09 (0.88,
Perceived income adequacy	6.1	0.07 (0.75.1.01)	2.6	1 10 (0 05 1 27)	1.3	0.02 (0.00.1.00)	7.6	1 20 (1 01 1 42)	<b>4 9</b>	0.0( (0.02.1.12)	0.1	1.02 (0.04
Adequate vs. inadequate	11.1	0.87 (0.75,1.01)	2.2	1.10 (0.95,1.27)	10.2	0.93 (0.80,1.09)	2.1	1.20 (1.01,1.43)	rai	0.96 (0.83,1.12)	10.0	1.02 (0.84
School grades	11.1	0.00 (0.66.0.07)	2.3	0.00 (0.01.1.10)	10.2	0.72 (0.00.00)	2.1	1 20 (0 05 1 51)		0.02 (0.00 1.00)	12.3	1 40 (1 11
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)	Ģ, <mark>e</mark>	0.83 (0.69,1.00)		1.42 (1.11,
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)	න 💆	0.82 (0.72,0.95)		1.35 (1.13,
Low vs. mid	10.1	0.98 (0.81,1.18)	7.0	0.92 (0.76,1.11)	2.0	1.13 (0.93,1.38)		0.86 (0.68,1.08)	ີຊີ	0.99 (0.82,1.19)	10.0	0.95 (0.74,
BMI	12.1	0 (4 (0 50 0 01)	7.8	0.74 (0.50.0.04)	3.0	0.70 (0.(1.1.00)	4.1	0.77 (0.50.1.02)	<u>6</u> 0.8 0	0.71 (0.5( 0.00)	12.8	1.06 (1.20
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)	ing, and simil	0.71 (0.56,0.90)		1.86 (1.38,
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)	and similar			1.59 (1.24,
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)	ec T	0.72 (0.61,0.85)		1.32 (1.09,
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)	n June techn	0.97 (0.76,1.24)		0.85 (0.62,
Obesity vs. Severe thinness/thinness/normal									ol e	1		
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)	, zu ogie	1.02 (0.82,1.26)		0.71 (0.53,
•												
Overweight vs. Severe		1 29 (1 09 1 52)		1.02 (0.97.1.22)		1 12 (0 02 1 24)		1 21 (1 00 1 49)				0.92 (0.66
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)	<u></u>	1.05 (0.88,1.24)		0.83 (0.66,

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

#### **BMJ** Open

35

	Daily expo	osure to sugary drinks	Daily ex	posure to fast food
Parameter		ads		ads
	Wald $\chi^2$	Odds ratio (CI)	Wald $\chi^2$	Odds ratio (CI)
Country	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)
Sex	1.5		0.4	
Female vs. male		1.07 (0.93,1.23)		1.03 (0.91,1.17)
Age	0.0		1.2	/
10-13 years vs. 14-17 years		1.00 (0.86,1.16)		0.95 (0.83,1.08)
Ethnicity	0.1		0.0	
Majority vs. minority		1.02 (0.85,1.23)		1.00 (0.85,1.18)
Perceived income adequacy	1.0		4.5	
Adequate vs. inadequate	0.4	0.94 (0.80,1.11)		0.88 (0.76,1.03)
School grades	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	<b>C 2</b> *	1.03 (0.83,1.29)	C 14	0.92 (0.76,1.11)
BMI	6.3*	0.72 (0.5(0.05))	6.4*	0.75 (0.50.0.04)
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		0.70(0.66000)		0.79(0.66002)
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		1 00 (0.96 1.20)		1 05 (0 95 1 20)
thinness/thinness/normal weight		1.09 (0.86,1.38)		1.05 (0.85,1.30)
Overweight vs. Severe		1 14 (0 04 1 20)		1 04 (0.99 1.24)
thinness/thinness/normal weight		1.14 (0.94,1.38)	101 4*	1.04 (0.88,1.24)
Exposure to screen based media (weekday	y) 88.2*	1.05 (1.04,1.07)	121.4*	1.05 (1.04,1.07)

Abbreviations: AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval. 59

60

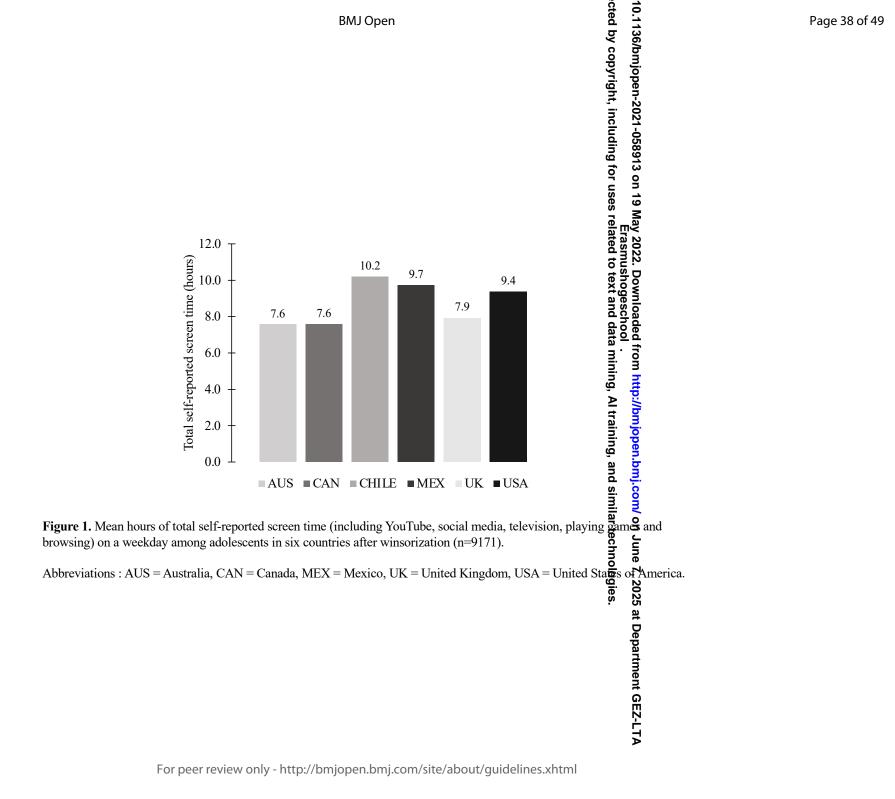
# **FIGURES**

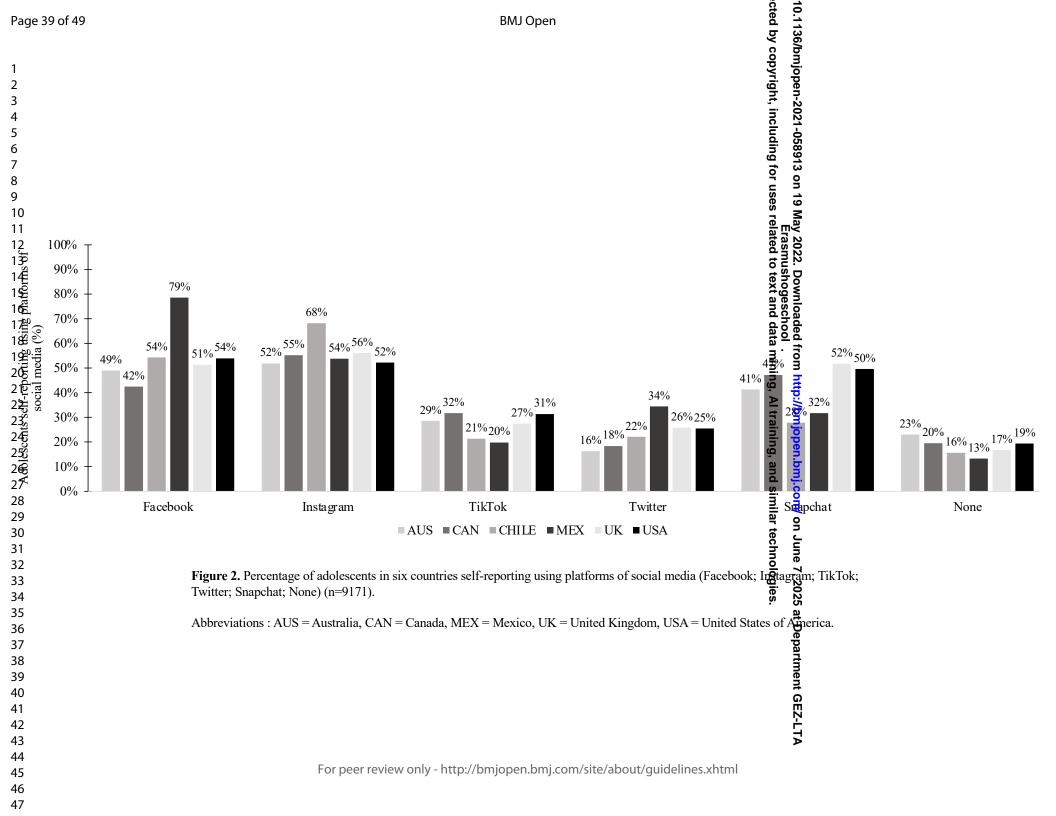
Figure 1. Mean hours of total self-reported screen time (including YouTube, social media, television, playing games and browsing) on a weekday among adolescents in six countries after winsorization (n=9171).

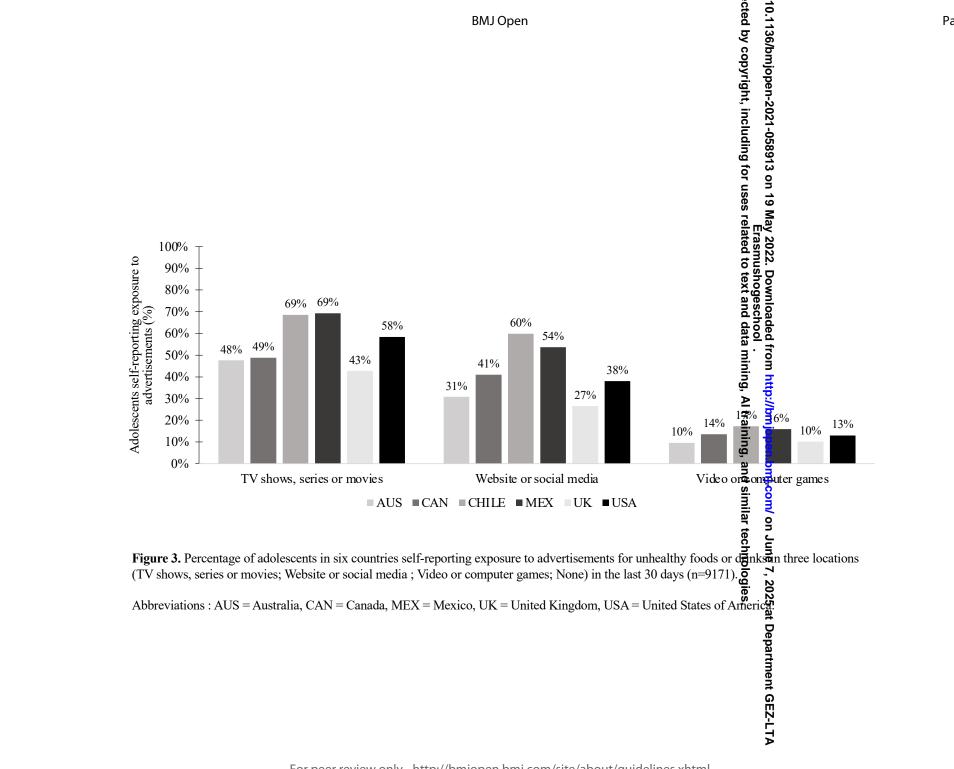
Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America. Figure 2. Percentage of adolescents in six countries self-reporting using platforms of social media (Facebook Instagram; TikTok; Twitter; Snapchat; None) (n=9171). Abbreviations : AUS = Australia, 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).

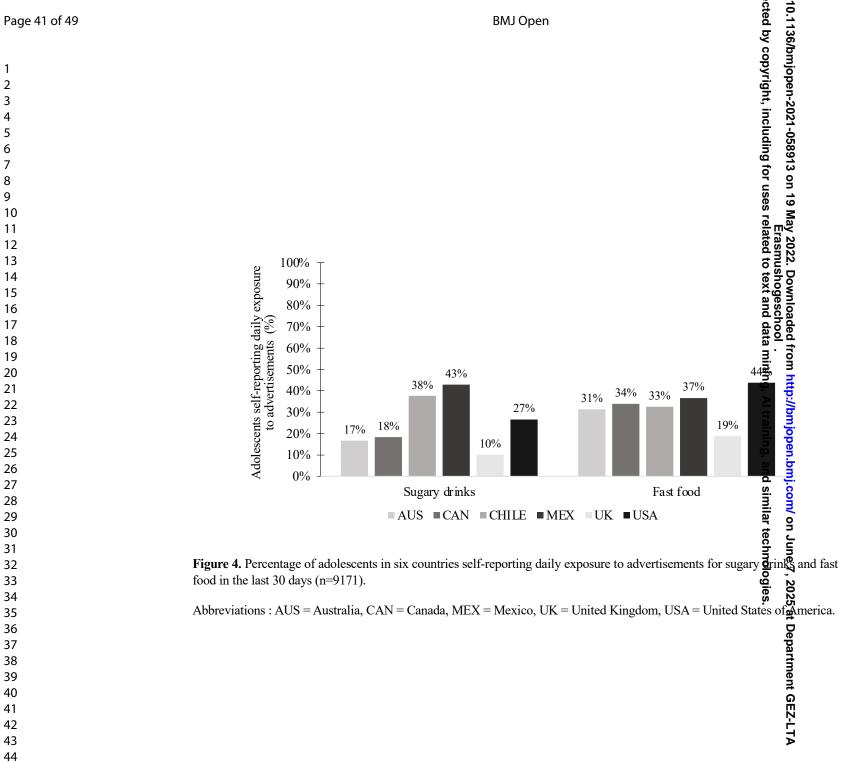
Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America. Figure 4. Percentage of adolescents in six countries self-reporting daily exposure to advertisements for sugary drinks and fast food in the last 30 days (n=9171). Abbreviations : AUS = Australia, CAN = Canada, MEX = Mexico, UK = United Kingdom, USA = United States of America.







For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml



BMJ Open: first published as 10.1136/bmjopen-2021-058913 on 19 May 2022. Downloaded from http://bmjopen.bmj.com/ on June 7, 2025 at Department GEZ-LTA Erasmushogeschool

Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies

# 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)
Country	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)
CAN vs. USA CHILE vs. MEX CHILE vs. UK CHILE vs. USA MEX vs. UK MEX vs. USA UK vs. USA Sex	15.0*	
Female vs. male		-27.0 (-44.9,-9.0)
Age	167.5*	
10-13 years vs. 14-17 years		-90.3 (-108.3,-72.4)
Ethnicity	13.0*	
Majority vs. minority		-32.9 (-56.3,-9.4)
Perceived income adequacy	32.0*	
Adequate vs. inadequate		-47.2 (-68.8,-25.7)
School grades	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)
BMI	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).

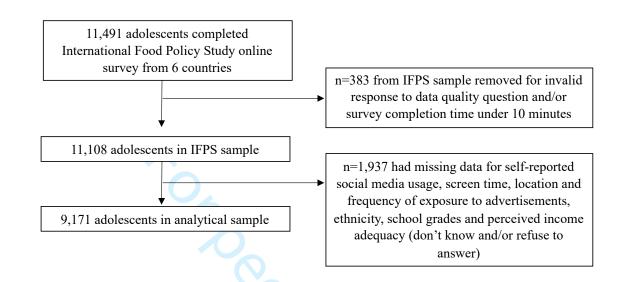
Parameter		sure to sugary drinks ads		sure to fast food ac
	Wald $\chi^2$	Odds ratio (CI)	Wald χ <sup>2</sup>	Odds ratio (CI)
Country	70.2*		24.8*	
AUS vs. CAN		0.88 (0.69,1.13)		0.88 (0.72,1.09)
AUS vs. CHILE		0.37 (0.28,0.49)		1.11 (0.86,1.44)
AUS vs. MEX		0.29 (0.22,0.39)		0.91 (0.71,1.17)
AUS vs. 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)
Sex	1.3		0.3	
Female vs. male		1.07 (0.92,1.23)		1.03 (0.91,1.17)
Age	0.0		0.7	
10-13 years vs. 14-17 years		1.01 (0.87,1.17)		0.96 (0.84,1.09)
Ethnicity	0.0		0.0	
Majority vs. minority		1.02 (0.85,1.23)		1.00 (0.85,1.18)
Perceived income adequacy	0.5		3.1	
Adequate vs. inadequate		0.95 (0.81,1.13)		0.90 (0.78,1.05)
School grades	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)
BMI	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
Exposure to screen based media (weekend day)	128.7*	1.06 (1.05,1.08)	186.5*	1.07 (1.06,1.08)

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

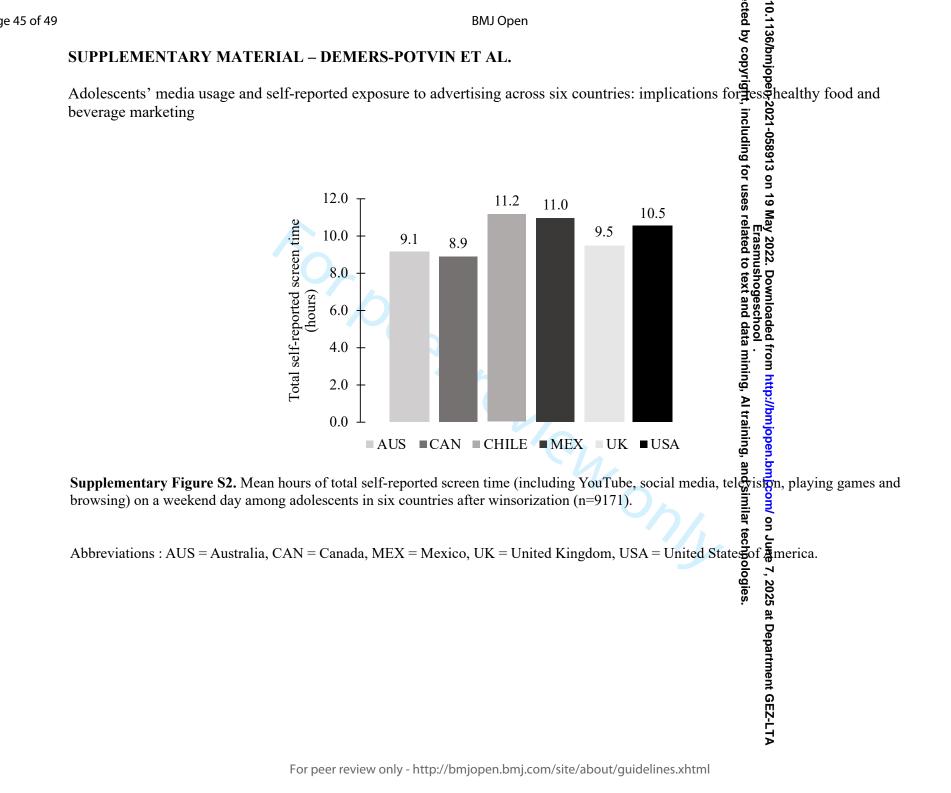
Notes : The variable listed second is the reference variable. Exposure to screen based media is expressed in minutes. Abbreviations : AUS=Australia, CAN=Canada, MEX=Mexico, UK=United Kingdom, USA=United States of America; CI = 99% confidence interval.

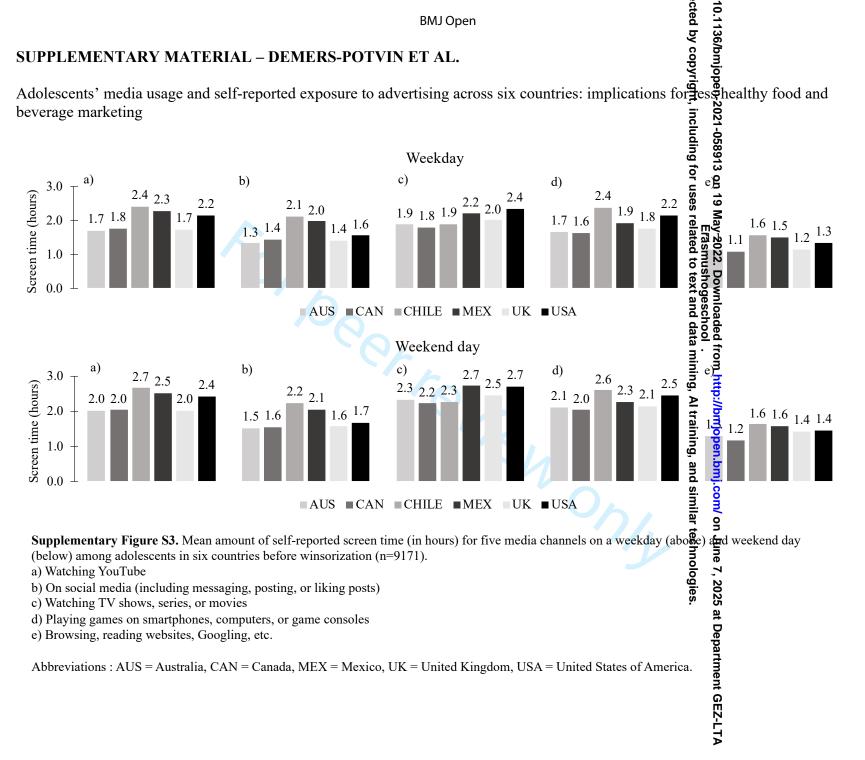
# SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.

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.

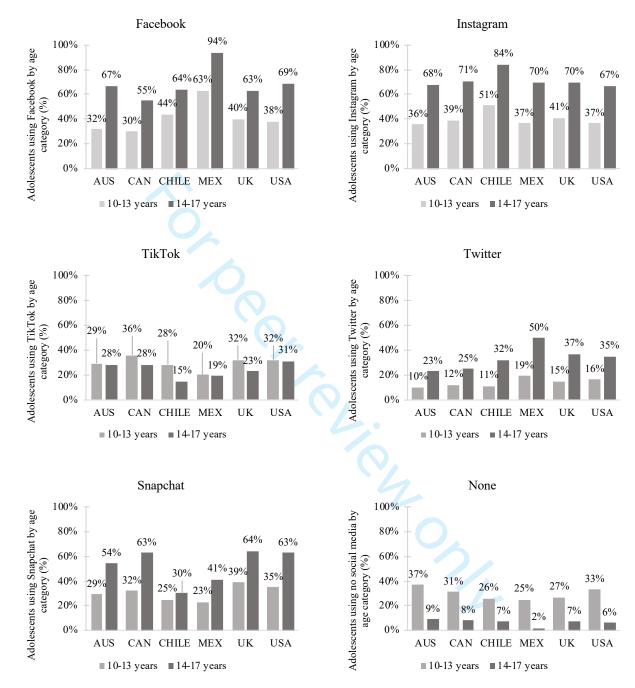




For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

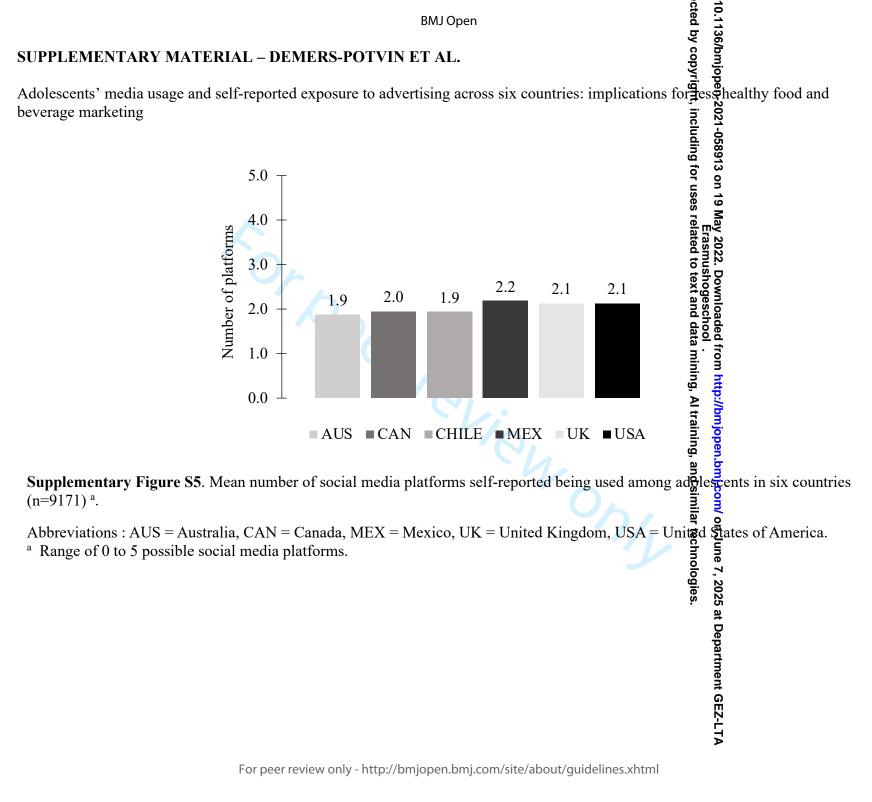
# SUPPLEMENTARY MATERIAL – DEMERS-POTVIN ET AL.

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.



	Item No	Recommendation	Page No
Title and abstract	1	( <i>a</i> ) Indicate the study's design with a commonly used term in the title or the abstract	3
		( <i>b</i> ) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
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
Methods			
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	( <i>a</i> ) 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/	8*	For each variable of interest, give sources of data and details of methods	8-11
measurement		of assessment (measurement). Describe comparability of assessment methods if there is more than one group	
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	( <i>a</i> ) 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
		( <i>d</i> ) If applicable, describe analytical methods taking account of sampling strategy	13
		( <i>e</i> ) Describe any sensitivity analyses	-
Results			
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
Outcome data	15*	Report numbers of outcome events or summary measures	14-16
Main results	16	( <i>a</i> ) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear	Table

Érasmushogeschool . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

2
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
23 24
24 25
25 26
20
27
28 29
~ ~
30 31
32
32 33
34 35
36
37
38 39
40
41
42
43
44
45
46
47 48
40 49
49 50
50 51
52
52 53
55 54
54 55
55 56
50 57
57 58
58 59
29

60

1 2

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

\*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.