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Digital Food Marketing Research: Global Trends

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About this report

This report for the Center for Digital Democracy and the Robert Wood Johnson Foundation builds on findings reported in *Obesity Reviews* (Tatlow-Golden et al., 2021), primarily updating the state of play in digital food marketing research methods. The report intends to be indicative of research trends to early 2024 rather than comprehensive. It draws on the author's expertise including current leadership of digital food marketing investigations in the UK, across the European Union, and in South-East Asia, Latin America and Southern/ Eastern Africa and has also benefited from insights kindly shared by scholars in global centers of excellence in digital marketing – in the United States, Canada, Mexico, Australia, New Zealand, and the United Kingdom – in a virtual round-table expert discussion in early 2023, led by Prof Tatlow-Golden and hosted by the Center for Digital Democracy.

About the author

Professor Mimi Tatlow-Golden PhD holds a personal chair in Interdisciplinary Studies of Childhood and Youth at The Open University, UK. Her expertise includes digital food marketing to children and youth and methods for its monitoring. Prof Tatlow-Golden has served as an invited member on many national and international expert panels on digital food marketing, including the US Healthy Eating Research Expert Panel on *Digital Food Marketing and Children and Adolescents' Health and Well-being* (2023-), the World Health Organization's *Digital Marketing Global Steering Committee* (2020-), the *Nordic Council of Ministers Food Marketing Working Group* (2016-7), the UNICEF *Committee of Experts on Digital Marketing of Unhealthy Food and Beverages to Children in Latin America-Caribbean* (2023) among others, and has given over 40 invited presentations and workshops in 16 countries since 2016, for WHO, UNICEF, the US National Academy of Sciences, Health Canada, the European Commission, national professional associations, and others. In 2016, she led WHO's first report on digital food marketing, a transdisciplinary analytical synthesis of its relationships with surveillance advertising, children's privacy, health, and its regulatory implications (World Health Organization, 2016). She also co-authored WHO Protocols and Templates for monitoring digital food marketing and leads the development of a WHO-EU food marketing monitoring protocol for a European Commission Joint Action.

SUMMARY

Marketing of unhealthy foods and non-alcoholic beverages (henceforth: food) has negative effects on the health and wellbeing of children under 18 years including youth (Boyland et al., 2022a; Boyland et al., 2016; Boyland & Tatlow-Golden, 2017) Drawing on systematic reviews and meta-analyses of experimental studies that demonstrate effects on food preferences, purchase requests and eating, the World Health Organization (WHO) and other major health and child rights bodies have concluded that unhealthy food marketing unequivocally has a negative impact on child health and should therefore be restricted, not only by reducing children's *exposure* but also reducing the *power* of such marketing: its formal features, persuasive appeals and marketing strategies (Boyland et al., 2022a, 2022b; WHO, 2010, 2016a, 2016b; 2018)

Although the bulk of the evidence of food marketing impact in systematic reviews and meta-analyses, still relates to TV marketing, and to effects on younger children rather than youth (E. Boyland et al., 2022), there is no empirical or theoretical evidence that indicates that the impact of unhealthy food marketing is lessened via digital media, nor indeed that its impact is reduced in adolescence. When considering the impact of digital marketing specifically, many factors come into play, including child and youth actual exposure, the extent to which they are individually targeted (with data-extractive surveillant technologies and/or relevant contextual data); the persuasive design employed by the relevant platform; the design of the marketing itself; and peer norms and effects, among others. The power of digital media marketing strategies

and appeals and their impact on children's well-being and their rights have been comprehensively covered elsewhere; see e.g., (Chester et al., 2021; Tatlow-Golden & Garde, 2020).

This report presents a brief overview of key current issues in digital food marketing to children including youth, focusing on what is known to date in the field; gaps in the research; and key challenges that scholars in the field face, with consequent implications for policymakers.

1. Digital food marketing research: largely descriptive, but studies of impact and exposure are growing

Evidence for child/youth *exposure* to digital food marketing specifically, and its *impact*, is currently small, although slowly growing. In the most recent systematic reviews and meta-analyses of food marketing impact, few studies of digital marketing are represented (where these are cited, most are studies of 'advergaming', reflecting an earlier focus on this modality and the time lag typical for large-scale reviews) (Boyland et al., 2022a). As evidence for the impact of digital food marketing specifically grows, however, studies are mirroring the findings for the impact of food marketing in TV and other modalities, showing that food marketing in digital media influences children's food and brand recall, attitudes, preferences, requests, and also their eating in experimental studies.

Most digital marketing studies to date are descriptive, indicating child/youth potential exposure by assessing the extent and nature of food brand marketing activity

in Facebook, Instagram, YouTube, TikTok, and the gaming platform Twitch, and marketing by social media influencers and celebrities in music and sports. This descriptive research has been essential to build evidence of food marketing activity on these various (and fast-changing) platforms and to illuminate the global activities of unhealthy food brands and products, supplying evidence of the messaging in such marketing and the norms created in the process. With just a handful of studies measuring child/youth *actual exposure* to digital food marketing or its *impact*, these are important challenges for the research field.

2. There is little evidence regarding digital food marketing in multiple key areas:

- a. The extent of child and youth actual exposure;
- b. The impact of digital marketing within diverse communities and across the world;
- c. The impact of brand vs product marketing, and of ‘health halo’ marketing;
- d. The targeting, exposure, and responses of adolescents/youth;
- e. Child/youth preference for ads and ad features, and how these relate to impact; and
- f. The impact (if any) of child/youth literacies of marketing, media, or food.

3. Methodological progress in measuring advertising exposure and in gaming

Measuring child and youth *actual exposure* to digital marketing is the major challenge currently facing researchers. As marketing is individually targeted in digital media (rather than being broadcast as on TV), researchers cannot assess its volume other than by accessing child/youth personal devices and recording their screens. Scholars in Canada, Mexico, and Australia have carried out, and in the UK, Ireland and New Zealand are currently carrying out, studies using diverse methods such as eye-tracking glasses, freely available apps, paid-for ‘digital ethnography’ apps; and video-conferencing apps such as Zoom or Teams.

These methods present exceptional challenges to researchers. First, securing ethical (IRB) approval

of studies extracting personal data from children’s devices (albeit with informed consent) can be difficult, although the views of research boards globally and within countries vary considerably. Second, the cost of materials (eye-tracking glasses and app subscriptions) associated with some methods can be high. Third, there is a considerable researcher burden in participant recruitment and retention. Fourth, manual data analysis of large volumes of recorded data is exceptionally onerous; to progress research in this field, the very large volumes of data produced by screen recording and similar modalities require automated image extraction (currently being developed) and, ultimately, automated means to identify products (this is still some way away). Each method therefore presents different methodological and ethical challenges regarding handling of children’s data and the burdens of recruitment, retention, and analysis. It is likely that peer-reviewed publications assessing the pros and cons of these modalities will appear over the next year or two.

More simply, individual data on aspects of child/youth digital food marketing exposure can be secured via self-report, with participants taking screenshots of ads they see on their devices, either on an app or with their camera and sending these to researchers. Scholars in Canada and Belgium are pursuing these approaches. This has the benefits of being a simpler, somewhat more privacy-protecting method that accords participants greater agency; however, caution should be applied in considering these as measures of exposure, as first indications (van Der Bend et al., 2022) are that young people do not notice all food marketing in their social media feeds, and therefore such methods are likely to yield underestimates of exposure.

4. Global centers of excellence in digital food marketing research

To identify the extent and nature of digital food marketing, research and methods innovation is led by public health scholars in North, Central and South America, Australia and New Zealand, the UK, and Europe. There is currently, to our knowledge, little research in other global regions, although UNICEF has initiated a program of descriptive studies in social media in South-East Asia, Latin America and the Caribbean, and Eastern and Southern Africa.

THE IMPACT OF DIGITAL UNHEALTHY FOOD MARKETING ON CHILDREN AND YOUTH

Systematic reviews and meta-analyses on the impact of unhealthy food marketing show unequivocally that it affects children's and young people's food preferences, purchase requests and eating. The World Health Organization and other major health and child rights bodies including UNICEF have concluded, based on this evidence, that unhealthy food marketing unequivocally has an impact and should be restricted (Boyland et al., 2022a, 2022b; WHO, 2010, 2016a, 2016b; 2019).

Although the bulk of the evidence in existing systematic reviews and meta-analyses still relates to the impact of TV marketing, there is no empirical or theoretical evidence to indicate that the impact of unhealthy food marketing is lessened via digital media and indeed many of its features indicate that its power is likely to be magnified by personalization, peer effects and the power of parasocial relationships (one-sided relationships with social media influencers and celebrities) (Murphy et al., 2020; WHO, 2016a). As the WHO *Set of Recommendations on the marketing of food and non-alcoholic beverages to children* notes (WHO, 2010), the impact of food marketing depends on *exposure* (frequency and reach) and *power* (the nature, creative content, design, and execution of the marketing message, e.g., use of persuasive techniques such as promotional characters). In considering the impact of digital marketing specifically, it is necessary to assess both exposure and power, and many factors therefore come into play, including child and youth actual exposure; the extent to which they are individually targeted with data-extractive surveillant technologies and/or relevant contextual data); the persuasive design employed by the relevant platform; the design of the marketing itself, its characteristics and persuasive appeals; and peer norms and effects, among others.

The power of many digital media marketing strategies and appeals and their impact on children's well-being and their rights have been extensively addressed elsewhere; see e.g., Chester et al., 2021; Montgomery, 2015; Tatlow-Golden & Garde, 2020; WHO, 2016a)

A SMALL BODY OF DIGITAL FOOD MARKETING EVIDENCE IS CURRENTLY LARGELY DESCRIPTIVE, BUT STUDIES OF IMPACT ARE GROWING

There is a relatively small but growing body of evidence specifically addressing digital food marketing, which is currently still weighted towards descriptive studies. Evidence for the *impact* on children/youth of food marketing specifically in digital media is currently small, although slowly growing. As a result, in the most recent systematic reviews and meta-analyses of food marketing impact, few studies of digital marketing are represented (see e.g., Boyland et al., 2022a) and these tend to be studies of 'advergames', rather than marketing in modes that children and youth are more likely to engage with, i.e., in social media (including influencer marketing) and on gaming platforms. This reflects the domination of advergame studies in the previous decade, the recent explosive growth of social media networks, and the time lag typical for large-scale reviews.

Where studies have assessed the impact of digital marketing, including influencer marketing, they show that digital food marketing influences children's eating in experimental studies. Studies of associations of digital food marketing with youth food and brand attitudes, preferences, and requests also show significant positive results, with greater internet use, or exposure to unhealthy food ads, linked to more positive unhealthy food attitudes and preferences.

Many studies of digital marketing are descriptive, providing accounts of the extent and nature of brands' marketing activity in Facebook, Instagram, YouTube, TikTok, and the gaming platform Twitch. Studies have also examined marketing by social media influencers and celebrities (music and sports). This essential research has built evidence of such activity and directed researchers to fruitful avenues. Importantly, it illuminates the global activities of unhealthy food brands and products and supplies evidence of the messaging in such marketing and the norms it attempts to create.

EXAMPLES OF STUDIES OF THE IMPACT OF DIGITAL UNHEALTHY FOOD MARKETING ON CHILDREN'S EATING

In the UK, Coates et al (2019) examined the impact on 9-11-year-old children of influencers' social media marketing of unhealthy food in a randomized, laboratory-based food intake trial. After viewing mock Instagram profiles of popular YouTube bloggers with unhealthy snacks, healthy snacks or non-food items and were free to eat as much as they wished of healthy or unhealthy snacks afterwards. The children who viewed influencers with unhealthy snacks ate significantly more, nearly 100 kcals, compared with children who viewed influencers with non-food items. Viewing influencers with healthy snacks did not significantly affect intake.

In Australia, Norman and colleagues (2018) randomly assigned 7-12-year-old children attending a six-day holiday camp in New South Wales to see food or non-food advertising in an online game, a TV cartoon, or both. All children who viewed food advertising in the online game plus the TV cartoon ate more at a snack compared with those who viewed non-food advertising, and did not eat less at the next meal, leading to a greater 46kcal daily eaten; and among children with heavier weight status, food advertising had a greater effect. This calorie differential for food advertising is enough to lead to overweight over time.

EXAMPLES OF STUDIES SHOWING RELATIONSHIPS WITH DIGITAL FOOD MARKETING AND FOOD AND BRAND PREFERENCES AND ATTITUDES

In Australia, Baldwin et al. (2018) carried out a survey online with 417 young people in New South Wales aged 10-16 years, asking about their internet and social media use, engagement with food and brand content, and how often they ate unhealthy foods. They found that watching YouTube food brand videos, purchasing food online and seeing favourite food brands advertised online were significantly associated with more frequent consumption of unhealthy foods and drinks.

In Ireland, Murphy et al. (2020) investigated attention, memory and social responses to advertising posts among young people aged 13-17 years. Participants viewed mocked-up social media feeds created to show age-typical content, each containing an advertising post for healthy, unhealthy or non-food items. Participants responded significantly more positively to ads for unhealthy food, compared to non-food and healthy food, on 5 of 6 measures: they recalled

and recognised a greater number of unhealthy food brands; they viewed unhealthy advertising posts for longer; and they were more likely to 'share' unhealthy content and rated peers more positively if they had unhealthy ads in their feeds. The latter findings indicate the social importance associated with unhealthy food marketing.

In Uruguay, Ares and colleagues (2023) carried out a randomized control trial to assess adolescents' advertisement and brand recall, brand recognition, attitudes, and food choice in a hypothetical scenario. They randomly assigned 433 teens to four different groups, who were shown YouTube ads for a burger, a healthy salad, a non-food item or none (the control group). They found the strongest effects for ad recall and brand recognition and that the burger ad was most easily recalled; effects on brand attitudes and food choices were seen in boys and teens who consumed burgers more frequently.

EXAMPLES OF DESCRIPTIVE STUDIES OF FOOD MARKETING ACTIVITIES

In Australia, Brooks and colleagues (2022)'s descriptive study of food marketing on Tiktok reviewed the content of 539 videos posted by 16 global food and non-alcoholic beverage brands (based on brand share). The most common marketing strategies were branding (87% of videos), product images (85%), engagement (31%) and celebrities/ influencers (25%). The total collective views of user-generated content from single branded hashtag challenges ranged from 12.7 million to 107.9 billion. Of 626 user-generated videos responding to brand-instigated hashtag challenges, 96% featured branding, 68% product images and 41% branded effects. The sentiments users portrayed in their videos were mostly positive (73%) with some neutral/ unclear (25%) and negligible negative sentiments expressed (3%).

In the US, Pollack et al. (2020) examined the presence of food and beverage marketing on Twitch.tv (Twitch) over Twitch streamer profiles, stream titles and chat rooms over 18 months in 2018-9. Identifying 238 food and beverage brands for processed snacks; food delivery services and restaurants; candies, energy drinks/coffees/teas; and sodas and other sugar-sweetened beverages), they found sodas, restaurants/food delivery services, candies, and energy drinks/coffees/teas increased significantly over the course of the study. Energy drinks, coffees and teas had the most exposure (1.08 billion exposure hours from profiles; 83 million exposure hours from titles), whereas in chat

rooms, restaurants/food delivery services and sugar-sweetened beverages were the most frequently mentioned products (each over 1 million messages).

In Mexico, Valero-Morales and colleagues (2023) assessed the nature and extent of food and beverage marketing on Facebook, Instagram, and YouTube posts of the top-selling food products and brands and the most popular accounts, analysing 926 posts from 12 food and beverage products and 8 brands. Of these, 91% were classified as unhealthy according to the Mexican warning labels nutrient profile and 50% were assessed as appealing to children, 66% to adolescents, and 80% to either children or adolescents. Most posts and the greatest engagement were found on Facebook. The most prevalent marketing techniques were the use of the brand logo, packaging and product images, hashtags, and engagement to consume.

In Uruguay, Gugliucci et al. (2023) carried out a content analysis of 2178 Instagram posts for ultra-processed products or brands, finding that pleasure from product consumption and health-related cues were the most prevalent marketing strategies used and that competitions and draws as well as invitations to interact encouraged users to engage and post comments.

Further descriptive studies are referenced below where further studies of food marketing in lower- and middle-income countries are discussed.

KEY RESEARCH GAPS

Extent of *actual exposure* to digital food marketing: This is the greatest methodological challenge facing researchers today in the targeted digital environment. As digital marketing is largely targeted depending on individual data traces (search, engagement, location, demographics, etc.), to provide evidence of marketing content received on that device, it is necessary to view young people's actual devices. This presents substantial technical and ethical challenges. This issue is discussed in the following section.

There is currently almost no evidence for the *impact* of digital marketing on different income and ethnicity groups. The most recent systematic review on differential exposure and hence potential impact (Backholer et al., 2021) found none, and the most recent overall systematic review (Boyland et al., 2022a) noted the absence of studies attending to questions of inequalities. This is a particularly urgent gap to be filled.

Furthermore, studies of targeting in digital media to particular ethnicities (whether by data on ethnicity directly or by inferences such as geographic setting/redlining and behaviour- and preference inferences) are also urgently needed.

Evidence of food marketing in lower- and middle-income countries is largely absent, with the great preponderance of studies in wealthy countries, yet existing descriptive studies (e.g., UNICEF studies in the Philippines, Argentina, Mexico, Kenya; as well as studies covering multiple countries, e.g. (Bragg et al., 2017; Cassidy et al., 2021; Matos et al., 2022) show that marketing in digital media in these countries is actively developing.

Food marketing and adolescents: The food marketing research field and policymakers have assumed for many decades that cognitive understanding of advertising can translate into resistance to it and as a result there has been little examination of the impact of marketing on teens. There is therefore a particular need for evidence – for impact of all kinds, and for exposure – regarding adolescents/youth, although as is shown in some studies highlighted in this report, researchers have begun to explore this age group. Theory indicates that for developmental reasons, both socially and biologically,

EXAMPLES OF STUDIES CONSIDERING DIGITAL FOOD MARKETING DIFFERENCES BY ETHNICITY

Some studies have explored aspects of ethnicity-based differences in digital food marketing engagement, an under-explored area where relatively little evidence even exists for TV. For example, Rummo and colleagues (2021) examined whether Black and Hispanic adolescents may disproportionately engage with unhealthy food and beverage brands on social media relative to White adolescents, purchasing demographic data of social media followers of 27 of the most marketed food/beverage brands on Instagram and Twitter. On Instagram, the percentage of Black followers of the selected brands (12.7%) was significantly higher than the percentage of Black followers of any account (7.8%). On Twitter, findings were similar for Hispanic users but opposite for White users. A higher racially targeted ratio was positively associated with the percentage of Black followers, and negatively associated with the percentage of White followers. Sugary drink brands had more Hispanic followers than low-calorie drink brands.

adolescents are indeed vulnerable to food marketing effects (Pechmann et al 2015) and, as noted above, some recent studies indicate relationships with attention, recall, preferences, and the preferences of peers (and hence, likely affects these cohorts' food and eating norms) (see Baldwin et al., 2018; Murphy et al., 2020).

Although researchers have good insights into what is overtly directed at children (e.g., bright colors, cartoons, etc.), the appeal of all other forms of marketing – including brand marketing – is less well known, as is the range of appeals that impact on children/youth. There is interesting research developing that seeks to specify the design features of advertising, i.e., its creative elements, or 'power', that children and young people themselves identify as appealing to their age group. These studies are finding that preferred features are quite diverse within age groups.

Notably, however, it should be assumed that food marketing can have an impact whether or not ads are overtly directed at particular age groups. A recent doctoral study presented at major conferences (Mediano Stoltze, 2021) indicates that any emotional advertising strategies, *whether 'child-directed' or not* in terms of their design, influence children's beverage preferences.

This important issue raises questions about whether, and how, different creative elements of marketing relate differentially to its impact on the values and behaviors that have long been evidenced in the literature – social and peer norms and behaviors such as taste expectations, preferences, purchase requests, purchases, and eating.

Future research should therefore consider how age-related design features (or power) and different advertising strategies (e.g., emotional vs informational) interact and how this may influence the impact of advertising/marketing itself.

EXAMPLES OF STUDIES OF FOOD MARKETING IN LOWER- AND MIDDLE-INCOME COUNTRIES

Cassidy et al. (2021) randomly selected official McDonald's Instagram accounts for 15 high-income, upper-middle-income and lower-middle-income countries (with 10 million followers in total) and captured 849 posts from September to December 2019. The three lower-middle-income countries had more posts ($n=324$) than the five upper-middle-income countries ($n=227$) and seven high-income countries ($n=298$). Notably, whereas approximately 12% of the posts in high-income countries were assessed as including child-targeted themes this was 22% in lower-middle-income countries; and price promotions and free giveaways were 14% in higher income countries compared with 40% in lower-middle-income countries.

In 2022, Matos et al. published an analysis of Facebook marketing by a soda brand with

major global reach, finding that it was the top five in the number of followers in the Facebook beverage segment in 57% of 149 countries. In a random sample of 10% ($n = 1217$) of all posts its marketing featured young adults, displaying its products, sports, and appeals to socialization and healthy eating.

Furthermore, UNICEF studies in the Philippines (UNICEF, 2021a), Argentina (UNICEF, 2021b), Mexico (Valero-Morales et al., 2023; UNICEF, 2021c), and Kenya (forthcoming) all indicate brand activity in digital media creating marketing with strong power features that appeal to children/youth including persuasive appeals to great taste, friends, family, fun, health, and physical activity. The great majority of posts are for products not recommended for marketing to children according to regional WHO nutrient profiling criteria.

Impact of brand vs product marketing, and of ‘health-halo’ marketing including marketing for ‘healthier’ and/or reformulated products within a brand: As regulators in some regions have moved to reduce food marketing impact on children, these questions are coming to the fore. They are poorly understood, e.g., the impact of brand marketing (where a product itself is not shown, but the brand is advertised, whether through logo exposures or entertainment/sporting events) or the impact on food preferences of health-focused marketing or marketing for reformulated products (e.g., full sugar vs sweetener sodas). Future research is urgently needed to address these highly policy-relevant factors.

Impact of marketing, media, or food literacy: There is a widespread assumption among policymakers that building young people’s literacy will provide solutions to their vulnerability to digital marketing of unhealthy foods. However, there is little or no evidence for this (Tatlow-Golden & Garde, 2020). Indeed, empirical and theoretical indicators point in the other direction. This is because food brand logo recognition reaches ceiling levels very early in life (pre-school) (Tatlow-Golden et al., 2014); it is then constantly further reinforced by frequent exposure in-store, in outdoor marketing, on transport, in school, at home, and in all forms of media, many times a day, throughout childhood and youth.

EXAMPLES OF STUDIES ASSESSING CHILDREN/YOUNG PEOPLE’S AD AND ADVERTISING FEATURE PREFERENCES

In Canada, Elliott et al. (Elliott et al., 2022), noting the research gap regarding techniques (‘power’) that capture adolescent attention, asked 62 teens aged 13–17 years to share examples of food marketing (in mainstream and digital media, and the built environment); participants identified and tagged 339 examples in 7 days and Instagram was predominant in the food ads participants saw (74%). They readily and consistently identified specified indicators, particularly visual style, special offer, and marketing theme, with participants aged 15+ more likely to report multiple indicators per ad.

In Uruguay (one of two high-income countries in Latin America that has a high distribution of internet connections and digital devices), Ares and colleagues have carried out a series of qualitative and quantitative studies examining adolescents’ views of and responses to food marketing online. In an initial qualitative exploration with 209 adolescents, they found that teens were all exposed to and aware of digital food marketing; were most aware of ads for fast-food restaurants and food-ordering apps; and the ad features they

found most memorable were images, colors, music, oversized portions, product novelty, price promotions and celebrities (Ares et al., 2022). Subsequently, adapting Elliott and Truman’s indicators, they analysed food marketing on Instagram (Ares et al., 2024) to assess them for nine indicators of marketing to adolescents (graphic design; language and memes; influencers; promotions; references to young people, movies, TV, music, video games, high school or university). Using these parameters, 17.6% ads were identified as targeted at adolescents, and mainly for snacks and non-core foods.

In the US, Bragg and colleagues (2021) carried out an online randomized trial to examine whether adolescents (13-17 years) preferred Instagram posts or traditional ads, such as those sourced from print media or online banner ads. Participants significantly preferred Instagram ads to traditional ads on trendiness, artistic appeal, and likeability, but the findings were the same for anticipated taste and likelihood to purchase – suggesting that social media advertising is preferred but food ads outside of social media remain effective.

METHODOLOGICAL PROGRESS IN MEASURING DIGITAL FOOD MARKETING EXPOSURE

The major challenge presented by assessing children's actual exposure can be seen in the fact that even advertising industry actors have not overcome it. For example, to carry out impact assessments of proposed policies restricting digital food marketing, the UK government commissioned Kantar to assess child/youth digital food marketing exposure. In the absence of actual exposure data, Kantar did so by making a series of estimates based on advertising and market spend and other data. The flaws in Kantar's approach and its resulting major underassessment of digital marketing exposure were unpacked step-by-step by Tatlow-Golden and Parker (2020).

Further studies carried out for the UK Advertising Standards Authority and the European Commission also have substantial limitations, despite being technically advanced 'avatar' studies that use bots with specified demographic characteristics to crawl the internet and identify advertising targeted at them. As these studies note (see below), they cannot assess actual exposure; they can assess potential exposure only, and crucially they cannot access signed-in environments, a substantial gap as much of child/youth internet activity (with the exception of YouTube use) involves signing in to social media and gaming applications.

The first steps in measuring *actual exposure* are underway. **Screen-based data collection of children/young people's exposure:** Scholars in Canada, Mexico, Australia, the UK, Ireland and Aotearoa, New Zealand have carried out, or are developing, studies using different methods such as eye-tracking glasses, freely

EXAMPLES OF STUDIES CARRIED OUT BY INDUSTRY-FACING CONSULTANTS, ESTIMATING CHILD/YOUTH DIGITAL FOOD MARKETING EXPOSURE

The 2017 Advertising Code of the UK Advertising Standards Authority (ASA) bans ads for unhealthy products in 'children's media' online and direct targeting of children up to age 16 (but permits them where media target a general audience). In 2019, automated child-identified profiles were created to carry out web crawling sweeps of 'clearly child-focused' YouTube channels; these sweeps identified 947 Code breaches; in 2020, 78 different HFSS ads from 29 advertisers were found on 24 websites and five YouTube channels. It is unclear what the implications are of the fact that the ASA sweeps focused on sites attracting 'disproportionately high' child audiences, as children are extensive users of general audience sites and channels: much, if not most, of children's online engagement is in cross-over territory such as social media, gaming, entertainment, and sports (Tatlow-Golden et al, 2021).

For the European Commission (2021), avatar studies developed by Advertising Intelligence Ltd (a Nielsen company) were applied to provide a snapshot view of the online advertising of food and drinks, particularly HFSS products served to adults and children across the Internet in three EU Member States. These visited websites only (not apps), aim to 'short-cut' ad server algorithms that search individuals' cookies for affinities with brands being advertised and seek to identify what would be served to individuals of specified ages. Visiting 60 YouTube channels and 221 websites, they identified 4787 ads, 67% of which were for high saturated fat, salt or sugar items, predominantly for sweet snacks. However the absence of any investigation of signed-in environments again compromises the ability of the study to reflect actual internet practices of children/youth and therefore limits the applicability of the findings.

available apps, paid-for 'digital ethnography' apps; and video-conferencing apps such as Zoom or Teams. These all present different methodological and ethical challenges regarding handling of children's data. Ethical (IRB) approval of studies extracting personal data from children's devices (albeit with consent) can be difficult to secure. Furthermore, the cost in some methods can be high and there is a considerable researcher burden in participant recruitment and retention, and in the manual data analysis of large volumes of recorded data.

To progress research in this field, the very large volumes of data produced by screen recording and similar modalities require automated image extraction for brand logos and, ultimately, automated identification of products with the capacity to update libraries of products and their nutrient profiles easily. This latter stage likely remains some way away, but substantial advances have been made by research teams in Brazil and in Australia with machine learning models that have the potential to dramatically reduce the time input by researchers when identifying advertising from video data of recordings from TV and from personal digital devices. In Brazil, Paola Horta and colleagues have developed the EfficientNet deep neural network, an image recognition system that differentiates food and non-food marketing on video. Trialled on 2124 TV video ads, containing 703 food ads and 20,000 non-food ads, the authors report 90.5% accuracy (Rodrigues et al., 2023). Meanwhile in Australia Backholer and colleagues at Deakin University are developing the SCANNER system to monitor children's exposure to, and engagement with, junk food, alcohol and tobacco advertising drawing on wearable eye-tracking glasses and machine learning to identify marketing content and children's responses. This is currently receiving its first field trial in the UK for a National Institutes of Health Research-funded study creating a baseline measure of children's exposure to food marketing in advance of the anticipated introduction of the Health and Care Act 2022 due to be implemented in 2025, restricting some modes of food marketing in digital media.

SCREEN-CAPTURE STUDIES PUBLISHED TO DATE AND THOSE CURRENTLY UNDERWAY

In Canada (U Ottawa), eye-tracking glasses were used to record 101 children and youth (ages 7-16 years) using their own devices (Potvin Kent et al., 2019) while using their two favourite social media apps for 5 minutes each. Researchers found that, with just 10 minutes' data for each participant, 72% were exposed to food marketing (including advertisements) and of the 215 food marketing exposures identified, most promoted unhealthy products such as fast food (44%) and sugar-sweetened beverages (9%). Based on their social media usage, it was estimated that children see food marketing on average 30 and times per week on social media apps, and adolescents 189 times per week.

In Australia, Kelly and colleagues at the University of Wollongong recorded the screens of 95 young people aged 13-17 years, for 2 weekdays and 1 weekend day via a freely available screen recording app (Lollipop), (Kelly et al., 2021), 267.8 hours of video data in total with 4446 (99.5% of food ads identified) not permitted to be marketed based on WHO nutrient profiling criteria. Participants saw a median of 17.4 food promotions each hour on the internet, translating to a median estimate of 168.4 food promotions on the web on mobile devices per week and most promotions (59%) were peer endorsed and derived from third-party sources.

At the University of Newcastle, Australia an online interview study with 35 youth aged 13-16 years, inviting participants to share their screen online with researchers (e.g., Zoom) and permit recording while they discussed what they viewed as they scrolled on their device (Van Der Bend et al., 2022)

Instagram, Snapchat and YouTube were the most favoured social media platforms, and across 1000 min of viewing time, 1801 instances of social media food posts content were identified, of which 580 were branded and two-thirds (62%) was embedded into celebrity influencer or entertaining content (e.g., vlogs, cooking videos, streamed TV content). Over half of the participants said they had sometimes, rarely or never noticed the social media food content pointed out by the researcher; they largely remembered non-core foods or brands (77%), and almost half (49%) of participants liked social media food posts, while only 6% disliked them.

These studies both show substantial amounts of exposure; van der Bend et al (2022) provides evidence that young people do not consciously register all the food marketing served to their devices. This has implications for self-report study methods, as noted below regarding the self-report studies. However, it does not attenuate the impact of the marketing itself, as advertising research into dual-process attention models shows that conscious awareness of advertising is not necessary for recall or to affect attitudes and behavior).

In Mexico (INSP) a screen recording study assessing children's exposure (screen recording via an app) (Nieto et al., 2023), recruiting 347 participants aged 6-19 years during the COVID-19 lockdown. They recorded 45 minutes of their device's screen time using screen-capture software, and 70% were exposed to digital food marketing, typically seeing a median of 2.7 food

marketing exposures per hour, 8 daily exposures during a weekday and 6.7 during a weekend day, allowing for an estimated 47.3 food marketing exposures per week (2461 per year). The most used marketing technique was brand characters. Marketing was appealing to children and adolescents and over 90% of products were not permitted for marketing to children according to WHO nutrient profiling.

In the UK, researchers at the University of Liverpool are leading a National Institutes of Health Research-funded study using an industry-standard 'digital ethnography' app that permits up to 10 minutes of screen recording at any given time – the study expected to complete data collection in 2023 with likely publication in 2024. In Ireland and in Northern Ireland for a Safer Food funded study, researchers at The Open University and the University of Galway will use Teams to record participants screens with their consent. Data collection will take place in 2023/2024 and publication is expected in 2024/2025.

Finally, in Aotearoa, New Zealand (U Otago), a study is underway using Zoom recordings of children's full digital media activities (not only marketing-focused) over several days (Gurtner et al., 2022), aiming to recruit 180 year 8 students from 12 schools will be recruited into the study within the Wellington region and will use Zoom video conferencing software to record real-time, screen-shared internet-based content, for 4 consecutive days. Data collection commenced in June 2021 and is anticipated to be completed in 2023. Recordings show children exploring diverse web-based settings and content, including on TikTok, YouTube, and Instagram. Behavioral Observation Research Interaction Software is being used to manually code recordings and Artificial Intelligence techniques being applied include hashtag extraction, optical character recognition, and object, pattern, speech, and lyric recognition.

Self-report data on children/young people's exposure:

More simply, individual data on aspects of child/youth digital food marketing exposure can be secured via self-report, with participants taking screenshots of ads they see on their devices, either on an app or with their camera and sending these to researchers. Scholars in Canada and Belgium are pursuing these approaches. This has the benefits of being a simpler, somewhat more privacy-protecting method that accords participants greater agency; however, caution should be applied in considering these as absolute measures of exposure, rather than as measures of the

advertising that adolescents consciously process. This is because first indications, as noted above (Van Der Bend et al., 2022) are that young people do not notice all food marketing while scrolling through their social media feeds - yet experimental research has shown conscious processing is not required for advertising effects to take place. Therefore, self-capture methods are likely to yield underestimates of exposure in digital media. However, these studies provide good measures of the marketing that adolescents consciously identify as marketing and allow researchers to assess its nature and power.

EXAMPLES OF STUDIES USING DIARY OR SELF-REPORTED EXPOSURE BY ADOLESCENTS

In Belgium, a diary study with 21 Flemish adolescents who took screenshots of food images they encountered on their social media platforms for one week, yielding 611 examples of food marketing shared with researchers. Of these, adolescents were mostly exposed to non-core (unhealthy; 67% of images) and branded (49% images) foods, with half showing social contexts such as hanging around with friends, eating at restaurants and celebrating with food. Adolescents often encountered branded food images through peers and social media influencers, and paid food marketing made up 40% of branded images with 49% of branded images 'earned' (i.e., shared by someone in their network) (Qutteina et al., 2019)

In Canada, the GrabFM! app is being developed to facilitate this approach (Truman & Elliott, 2022; Elliott & Truman, 2024). They evaluated it with quantitative user response rates and qualitative focus group discussion feedback in a pilot with 62 teenagers (ages 13-17) who gave positive feedback on usability, including ease of use and design aesthetic appeal; subsequently, 278 participants (aged 13-17; 63% girls) captured 1392 food ads that the teens considered teen-targeted over 7 days (an average of 0.72 ads per participant a day) from Instagram, Snapchat, TikTok and YouTube. Nearly half (46%) were from Instagram and the most frequently advertised categories were beverages, fast food and candy/chocolate.

GLOBAL CENTERS OF ACTIVITY IN DIGITAL FOOD MARKETING RESEARCH

Research and methods innovation to identify the extent and nature of digital food marketing research to children is led by public health scholars in North and South America, Australia and New Zealand, the UK, and Europe. On digital food marketing specifically (compared to other marketing modalities) there is little research in other global regions, although UNICEF has initiated a program of descriptive studies in social media in South-East Asia, Latin America and the Caribbean, and Eastern and Southern Africa. The scholars and NGOs listed below are supported by grants from major national governmental health and public health funders; non-governmental charities (e.g., cancer, heart foundations) as well as external funders for UNICEF (including Bloomberg and the government of the Netherlands).

Key sites and scholars examining digital food marketing include, but are not limited to:

- **US – New York University:** Marie Bragg, Omni Cassidy; **University of Pennsylvania:** Travis Masterson; **Rudd Center at University of Connecticut:** Frances Fleming-Milici, Jennifer Harris
- **Canada – University of Ottawa:** Monique Potvin Kent; **University of Calgary:** Charlene Elliott, Dana Olstad
- **Australia – University of Wollongong:** Bridget Kelly; **Deakin University:** Kathryn Backholer
- **New Zealand – University of Otago:** Louise Signal
- **UK – University of Liverpool:** Emma Boyland
- **UK and Ireland – The Open University:** Mimi Tatlow-Golden, Magdalena Muc
- **Mexico – National Institute for Public Health (INSP):** Simon Barqueras, Claudia Nieto
- **Uruguay – Universidad de la República:** Gastón Ares
- **Brazil – Federal University of Minas Gerais**
Paula Horta
- **Belgium – KU Leuven:** Tim Smits, Yara Qutteina;
SCIENSANO: Stefanie Vandevijvere
- **Portugal –** Margarida Bica, Maria-Joao Gregorio
- **Austria –** Eva Winzer, Brigitte Naderer
- **Slovenia, Finland, Norway, Estonia (National Institutes/Ministries)**

WHO (particularly the WHO European Region office's Non-Communicable Disease unit) **and UNICEF** are major NGO actors in this field. In addition to reviewing research and developing policy they actively support academic researchers, policymakers' monitoring, and research methods development in the field.

Finally, the European Commission (which shapes the European Union's strategy and proposes new EU laws and policies), funds research and large-scale implementation and dissemination networks including Joint Actions that aim to develop and embed best practice across EU Member States. The [Best ReMaP Joint Action](#) which concluded in September 2023 has been followed by the start of [JA PreventNCD](#) (2024-27), a new collaborative initiative across 25 European nations forming a 4-year implementation network (Klepp, 2023). Acknowledging that health is created by policies across sectors, PreventNCD aims to address NCD risk factor root causes including marketing of unhealthy commodities; build on existing knowledge and explore new methods for monitoring risk factors and disease burden; identify the impact of policies and interventions; minimise fragmentation; and tackle social inequalities by considering the health and health equity implications of these policies.

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