

## Rising to the challenge: Introducing protocols to monitor food marketing to children from the World Health Organization Regional Office for Europe

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**Keywords:** Marketing, digital, children, food, monitoring, regulation

**Acknowledgements:** The authors would like to acknowledge contributions of Dr Anna Coates to development of the Influencer Protocol and Margarida Bica to Protocol introductory material.

**Funding information:** The authors gratefully acknowledge support through a grant from the Russian Government in the context of the WHO European Office for the Prevention and Control of NCDs.

**Statement of ethics:** This paper is a review article and therefore does not report new empirical research involving human subjects

**Potential conflicts of interest:** The authors declare no conflict of interest. The funders played no role in the design of the WHO/Europe monitoring Protocols, the decision to write this paper, or its content.

**Disclaimer:** OZ, KW and JB are staff members of WHO and JJ is a former WHO staff member. The authors alone are responsible for the views expressed in this article and they do not necessarily represent the views, decisions or policies of the institutions with which they are affiliated.

**Abbreviations:** ASA, Advertising Standards Authority (UK); COSI, WHO European Childhood Obesity Surveillance Initiative; HFSS, high in saturated fat, sugar, and salt; NCD, noncommunicable disease; RCT, randomized controlled trial; UN, United Nations; UNCRC, United Nations Convention on the Rights of the Child; VPN, virtual private network; WHO, World Health Organization.

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### Abstract

Unhealthy marketing has been unequivocally linked to children's food preferences, requests, purchases and eating behaviours, and hence to childhood obesity. Regulating children's exposure to such marketing has been identified as a key challenge to which States must rise. Regulation mandates the need for monitoring, and hence for credible data that are comparable between countries, regions, and across time. However, there are major challenges presented by the complexity of the digital marketing ecosystem including the personalised targeting with persuasive, exploitative advertising to which children are subject. This narrative review identifies challenges faced by researchers in the digital ecosystem; reviews recent papers attempting to address these and specifies benefits and limitations; and introduces a set of WHO protocols with templates and guidance for studies of food marketing to children.

## Introduction

Childhood obesity is a global concern in the 21<sup>st</sup> century, not only in wealthier countries but also increasingly in low- and middle-income countries affected by the 'double burden' of undernutrition and obesity<sup>1-5</sup>. A growing body of evidence shows links from childhood to adulthood obesity, and propensity to noncommunicable diseases (NCDs) both in childhood<sup>6,7</sup> and later in life<sup>8,9</sup>. Obesity and NCDs are also implicated in negative outcomes for communicable diseases such as COVID-19<sup>10</sup>. Attending to these, including by addressing underlying social and environmental factors, is therefore of greater urgency than ever before<sup>11</sup>.

Marketing of unhealthy products — typically defined as those high in saturated fat, salt and sugar (HFSS)<sup>12</sup> — and of the brands that promote them is, according to the World Health Organization (WHO), unequivocally linked to children's food preferences, requests, purchases and eating behaviours, and hence to childhood obesity<sup>4</sup>. Therefore, regulating children's exposure to such marketing is a key challenge to which States must rise. This requires credible monitoring data that are comparable between countries, regions, and different time points. Yet monitoring children's media exposure to food marketing, and particularly in digital media, presents substantial challenges. This structured narrative review has three goals: to

1. Outline the need for methods to monitor digital media for children's exposure to unhealthy marketing, and its power;
2. Identify existing methods and evidence; and
3. Introduce a new set of WHO/Europe resources (protocols, templates and training materials) for collecting credible, rigorous, replicable monitoring data for digital media and television.

In Part 1 we summarise the digital marketing ecosystem and food marketing strategies, to identify the need for replicable monitoring methods. We draw on selected peer-reviewed papers and grey literature, including the findings of expert workshops in 2016 and 2018 facilitated by the WHO Regional Office for Europe<sup>13,14</sup>, at which over 40 public health experts and researchers from the fields of psychology, food marketing, online marketing, technology, law and ethics identified challenges and potential technical solutions to monitoring children's digital marketing exposure.

In Part 2, we identify methods developed to date and findings they can facilitate, focusing particularly on digital marketing exposure and power. Using a secondary extraction of digital marketing studies from a 2019 PROSPERO-registered review on food marketing and children<sup>15</sup>, updated 2020 searches, and consultation with experts, we identified peer-reviewed journal articles and grey literature. Finally, Part 3 introduces the WHO/Europe protocols. These support studies of digital and television food marketing to which children are exposed, and its power. Developed via a consensus process between three authors with international expertise in research, monitoring and protocol development (MTG, JJ, EB), the protocols specify key variables as well as processes, training materials and templates for monitoring digital food marketing. This will facilitate global comparability, international capacity building, and validation of developing technical solutions.

## Part 1: The need for monitoring methods for digital food marketing

The impact of food marketing on children's eating and related behaviours has been widely demonstrated in reviews and meta-analyses<sup>16-19</sup>. Exposure to unhealthy food marketing prompts

additional consumption, increasing snack calorie intake that is not compensated for by reduced intake at the next meal, and therefore has sustained impact over time<sup>20,21</sup>. Evidence is unequivocal that childhood obesity is influenced by consumption of such unhealthy items<sup>4</sup>.

In 2010, the World Health Assembly endorsed the WHO Set of Recommendations on the Marketing of Foods and Non-Alcoholic Beverages to Children<sup>12</sup>. These concluded that children's exposure to marketing and its power affects behavioural outcomes (*i.e., attitudes, preferences, purchase requests and consumption*). *Exposure* refers to the volume of marketing, as determined by the frequency of marketing messages and their reach (*i.e., how many messages reach children and via which media?*). *Power* refers to message creative content, design and execution that enhance persuasive appeal (*i.e., what techniques are particularly effective in persuading children?*). Therefore, the policy objective is to limit children's exposure to such marketing; to reduce its power; and to do so comprehensively in all settings 'where children gather'<sup>12</sup>.

Calls to protect children comprehensively from food marketing have since been made by WHO, United Nations (UN) Special Rapporteurs, and many civil society bodies<sup>5,22-24</sup>. In 2016, WHO set global and comprehensive targets to halt rising obesity<sup>5,23,25</sup>. In 2016, the WHO Commission on Ending Childhood Obesity<sup>4</sup> noted that unhealthy food marketing remained a major worldwide public health issue despite some industry self-regulation. A major WHO transdisciplinary review<sup>5</sup> identified challenges and rights issues associated with the complex digital advertising ecosystem.

### **Children's rights**

Food marketing is increasingly being identified as a practice that infringes children's rights<sup>5,26</sup> (per the United Nations Convention on the Rights of the Child (UNCRC) this relates to those under 18 years of age<sup>27</sup>). The 2020 WHO-UNICEF-Lancet Commission proposed adding a UNCRC Optional Protocol on commercial marketing and the targeting of children, to better protect children against harmful marketing by legal means<sup>1</sup>. In digital media in particular — as a result of the affordances and practices of digital media platforms and the extensive marketing that underlies their business model — food marketing infringes rights to food and to health, but also rights to privacy and to freedom from exploitation<sup>28</sup>.

Importantly<sup>27</sup>, any rights-based perspective on food marketing must take into account children's UNCRC rights to *participation*. Children's participation in digital media should not be predicated on receiving rights-infringing unhealthy advertising<sup>5</sup>, and calls to regulate unhealthy food marketing in digital media (henceforth referred to as digital marketing) have been growing apace. These specify the need to protect not just younger children but also adolescents<sup>23,24,26,28</sup>, due in part to adolescents' extensive use of digital media. It is also increasingly understood that information-based cognitive advertising and media literacy provide little protection against food marketing effects<sup>5,28-31</sup>, particularly given the manipulative strategies of digital marketing<sup>5,28</sup>. Digital food advertising targets adolescents specifically, drawing successfully on their social-developmental needs for connection with peers, activating emotional, identity-laden responses, and building long-lasting relationships with brands<sup>32-36</sup>. Social media companies and search engines, brands and marketers have devised an exploitative system that uses persuasive techniques and design to extract children's data, privacy and their finite attention<sup>28</sup>.

### **Children's media use**

One in three of the world's internet users are children<sup>37</sup>. Children are also extensive users of social media: in the UK, for example, 71% of 12-15-year-olds and 21% of 8-11-year-olds have a social media profile. YouTube is the most viewed site by children in general<sup>38</sup> even though social media platforms including YouTube state they require users to be over 13 years (YouTube Kids offers limited content for young users). Most children globally access the internet and digital applications via mobile devices<sup>39</sup> and thus parental oversight and awareness of food marketing is limited<sup>40</sup>. It should be noted that even where high proportions of children have access to digital devices, they also spend considerable time watching television<sup>41</sup>.

### **Advertising in digital media**

Advertising practices have changed dramatically since 2010 with rapid growth of digital and mobile advertising fuelled by personalized and other data-driven approaches. Digital ad spending has increased substantially worldwide<sup>42</sup>; rather than buying space in specific publications or settings, global technology platforms have automated the purchase of targeted advertising impressions, known as *programmatic* advertising. The complex programmatic system, and extensive growth in alternative formats facilitated by the affordances of digital media, particularly social media, mean that formal advertising metrics do not capture much digital advertising and marketing (some is not paid for at all)<sup>43</sup>.

Digital advertising and marketing strategies and the structural features of the advertising economy together create exceptional challenges in assessing children's exposure to unhealthy food marketing. Many digital marketing techniques are not recognised as formal advertising as they do not involve ad placement in a specified, paid-for location<sup>42</sup>. The 'brand activation' market, estimated at three times the size of paid-for digital advertising, blurs boundaries between advertising and content<sup>42</sup>, including strategies such as 'earned' advertising, influencer marketing, peer marketing, event and game stream sponsorship. 'Earned' social media advertising is forwarded by users within their networks, encouraged by social media and marketing design<sup>32,33,44,45</sup>, e.g., the use of hashtags and prompts to 'like', 'share' and 'tag' others in branded posts. This facilitates exponential spread of marketing<sup>5,46</sup>, and amounts to recruiting children to act as peer marketers. Earned marketing/advertising is believed to be particularly detrimental to children, as it is less clearly identifiable as commercial content<sup>46</sup>.

'Native' marketing, shown within social media feeds, reflects the design features of these social media and is boosted by social media algorithms<sup>5</sup>. It is favoured by food and drink industries<sup>42</sup>. Advertisers say that, compared to more easily identifiable 'display' advertising, native advertising delivers a greater subconscious reaction and 28% increased views on mobile devices<sup>42</sup>. Many such strategies are fuelled by the shift to mobile devices, described by marketers as a 'brand in the hand': a personal, individual-level interaction that increases opportunities to establish intimate relationships with customers<sup>28</sup>.

The most popular social media influencers have millions of subscribers or followers, and many more view their content<sup>24</sup>. In the UK, marketers report that young people are significantly more receptive to celebrity and influencer marketing<sup>42</sup> than other advertising, and marketers' studies show children trust influencers more than movie celebrities<sup>5</sup>. Qualitative studies reveal children's beliefs about

influencers: in Norway, 13-to-15-year-olds believed YouTube influencers' promotion of products was genuine and free of influence<sup>47</sup>; in the UK pre-teens felt particular sympathy to familiar YouTube influencers<sup>48</sup>.

### **Food marketing in digital media**

Food marketers and brands actively engage in the strategies described above and more, creating advertising that is engaging, immersive and enjoyable, speaking to interests such as entertainment, music, sport and gaming. Using youth-focused strategies of humour and fun, and linking to local 'special days' such as Hallowe'en, brands achieve virality, sometimes reaching audiences of millions with a small outlay<sup>5,42</sup>.

In social media, food brands aim for powerful relationship-building. Representatives of sugar-sweetened beverage and fast-food brands state their intent to establish close connections with consumers through dialogue, kinship, collaboration and active co-creation, aiming to cultivate a parasocial relationship between young people and the brand<sup>42</sup>. Coca-Cola's Chief Digital Officer states emotional connection prompts consumers to 'participate, actively and co-create' social media content 'tens of thousands of times a day because of their love and their community with the brand'<sup>49</sup>. This, it has long been argued<sup>32</sup>, and evidenced in industry documentation<sup>42</sup>, is further amplified by peer marketing strategies. Furthermore, recent experimental evidence finds that when viewing social media content, adolescents prefer peers with unhealthy food advertising posts in their social media feeds, and are more likely to share unhealthy content themselves, compared to healthy food advertising posts or ads for non-food products. They also pay more attention to ads for unhealthy products and remember them more<sup>34</sup>. This is likely due at least in part to the adolescent values and interests that are powerfully communicated in such advertising, as described above<sup>5,40</sup>. Food is the second most active industry in 'influencer' marketing on media sharing sites such as YouTube<sup>42</sup> and is often promoted by influencers popular with children<sup>24,32,33</sup>. Children eat more snacks after viewing influencer food marketing compared to children watching the same influencer promoting non-food items<sup>50,51</sup>. Unhealthy food brands are also avid sponsors of local, national, regional and global games such as soccer and rugby World Cups and lifestyle, entertainment and attention-gathering events and high-risk sports (e.g., ballooning, paragliding) that gain extensive social media reach<sup>42</sup>.

The dynamism of the digital marketing system and its use of salient themes can be seen in its response to the COVID-19 pandemic. Brands were advised to 'build salience and mental availability' and food and drink brands capitalised on emotive COVID-related themes of boredom, comfort and being 'in this together'; rapidly developed promotions, e-commerce and increased product availability online were recorded in nearly 800 campaigns across 90 countries<sup>42</sup>.

### **The digital advertising ecosystem**

The nature of digital marketing creates challenges in specifying its spend and reach, and the system's structural features make it particularly complex and opaque<sup>5,42,52</sup>. The programmatic ad delivery system is highly fragmented, involving many different players in a chain of consumption, sale and delivery. As a result, publishers, media agencies and brands cannot identify all the ads any given user is shown. Without accurate data on people's age, programmatic advertising delivers unhealthy marketing to children by design<sup>52</sup>. The dominant advertising platforms (e.g., Google/ YouTube,

Facebook/Instagram, Amazon and emerging scale platforms like Snapchat and TikTok) operate their own full-stack technology systems (complete systems covering user to back-end) within 'black boxes': they have the data and power to identify individual users' advertising exposure, but are unwilling to share this<sup>5,52</sup>. There are methodological, ethical and legal challenges to accessing data within black box systems as companies do not provide access, prohibiting research they have not sanctioned<sup>13</sup>. These factors combined — advertising directed to individuals' interests by an automated system; a vast advertising landscape; and an absence of independent public data — present a 'wicked problem' (a complex problem, challenging to define and solve) for public health and researchers, to which there is currently no easy solution.

### **Industry views on children's exposure to marketing for unhealthy items**

Surprisingly, even the advertising and media industries are unable to measure children's overall marketing exposure comprehensively<sup>42</sup>, and contradictory claims are made about the extent of such exposure. Some industry players point to endemic online ad fraud, as automated 'bots' inflate the number of visitors to sites to boost advertising revenue<sup>53</sup>. Others claim that children are exposed to negligible, if any, digital marketing for unhealthy foods<sup>54,55</sup>. Yet brands and marketers themselves consistently report that marketing for HFSS items amplifies traditional advertising, delivering increases in ad attention, recall, positive brand awareness and attitudes, intent to purchase and sales<sup>5,42</sup>. Furthermore, social media targeting tools, using online behavioural analysis, facilitate targeting those who are most susceptible to these messages, and often (for example via geotargeting) even in moments of greatest opportunity, making ads potentially far more powerful<sup>5</sup>.

### **Existing regulation and its limits**

Currently, regulation of unhealthy food marketing to children relies on industry self-regulation, even though this has been demonstrated to have little effect<sup>24,56</sup>. Over 10 years since the WHO Set of recommendations was adopted, its implementation remains patchy and often weak<sup>24</sup>. A 2018 WHO European Region review concluded that even where food marketing regulations exist, they are not comprehensive: they do not include digital media, or do so in a limited way; rarely extend to adolescence; have limited scope, with a focus on 'children's media', so children continue to be exposed to substantial advertising elsewhere; and focus on *products*, allowing brands to continue to advertise.<sup>24</sup>

Crucially, comprehensive monitoring strategies are absent even in the few countries that have introduced digital marketing restrictions, such as the UK and Portugal (on unhealthy foods) and Finland (on alcohol), or proposed them, such as Ireland. The limited UK monitoring demonstrates unhealthy digital advertising continues to reach children despite current regulation. The 2017 Advertising Code<sup>57</sup> 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). Yet in 2019, automated web crawling sweeps by child-identified profiles of 'clearly child-focused' YouTube Channels<sup>57</sup> identified 947 Code breaches; in 2020, 78 different HFSS ads from 29 advertisers were found on 24 websites and 5 YouTube channels<sup>58</sup>. The ASA's automated web crawling method was unable to determine the extent of children's exposure, or to access social media or other internet environments requiring sign-in. It also focused on sites attracting 'disproportionately high' child audiences<sup>57</sup>. Yet studies of digital media use<sup>38,41</sup> indicate 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<sup>59,60</sup>. This mirrors TV findings: in the UK, for example, only 25% of children's TV viewing time is spent watching 'children's' programming (p. 267)<sup>61</sup>.

In 2019, a UK government Impact Assessment assessed how further restrictions of both television and digital marketing for unhealthy foods might benefit children's health<sup>62,63</sup>. It concluded that even with current regulations, UK children see 3.6 billion unhealthy ads on TV annually. Noting that no measure of children's digital exposure exists, it published an estimate of 0.73 billion impressions (successful ad loads) via digital devices. Yet subsequent analysis demonstrated this figure was a grave underestimate<sup>42</sup> and in 2020 the next government consultation updated it to 15.1 billion<sup>64</sup>. Notably, this suggests that even in the UK, with long-standing media food marketing regulations, children continue to be exposed to very extensive advertising for unhealthy foods on all media. This indicates the importance of ongoing monitoring to support effective, evidence-based policymaking. Monitoring of advertising on broadcast television is more straightforward, although increasingly television is also moving towards programmatic advertising delivery. A substantial body of literature describes television content analysis methods and outcomes<sup>17</sup>, so for the purposes of brevity this will not be covered here.

### **New digital restrictions in the WHO European Region**

Recent new regulations introduced or planned include the UK Government's<sup>10</sup> 2020 announcement of a pre-9pm 'watershed' ban on advertising unhealthy foods on both television and online from 2022, and a consultation on introducing a full online ban<sup>64</sup>. In 2019, Portugal approved statutory regulation restricting marketing of unhealthy foods and drinks targeting under-16s (Law no. 30/2019 of 23 of April. No 79/2019, Série I de 2019-04-23. Diário da República). This covers schools, public playgrounds and surroundings, television, on-demand media services, radio and cinema, and websites and social networks where contents are intended for under-16s (though not influencer marketing). In 2020, Google introduced restrictions on advertising foods and beverages to under-18s in the UK and the European Union, albeit without indications of how this would be audited<sup>65</sup>. The scope, implementation and impact of these measures remains to be specified.

We next identify research methods available for assessing food marketing exposure and power in Part 2, before outlining potential solutions in Part 3.

## **Part 2: Research methods developed for assessing food marketing in digital media: a narrative review**

To identify currently available methods to assess children's real-world exposure to unhealthy food marketing, its power and impact, a secondary extraction of papers (n=75) was carried out by EB from a recent (2019) PROSPERO-registered review<sup>15</sup>. MTG and EB independently examined titles and abstracts, excluding those where both agreed that the study did not meet the inclusion criteria (n=22 included). A further 15 papers were added from searches of reference lists, grey literature and consultation with experts, for a total of n=37. Inclusion criteria were:

1. Assesses marketing to which children may be *exposed* in digital media; the *power* (nature) of marketing for brands and products popular with children in digital media; or its *impact*;

2. Examines digital settings that children are likely to use frequently (social media, media sharing sites, gaming);
3. Provides a clear description of the method;
4. Reports primary data;
5. Full peer-reviewed publications, or grey literature employing a method indicative of extent of marketing or exposure; and
6. Published since 2010.

To maintain a focus on studies indicating current real-world exposure, and due to space limitations in this review, food company websites and food advergames were excluded on the assumption that children are less likely to spend substantial time on these<sup>5</sup>. Reviews (systematic, scoping or narrative) were also excluded.

MTG and EB grouped these studies into five clusters. The first three clusters were methods-focused: (a) content analyses of marketing power in social media where selections were based on brands' marketing scale (advertising expenditure, social media followers, or sales) but not popularity with children; (b) content and exposure analyses of food marketing in social media, based on some measure or inference of child popularity; (c) methods that indicated aspects of children's actual exposure. Studies assessing the impact of digital marketing were: (d) surveys of attention, recall, attitudes, and self-reported consumption; and (e) experiments including actual food consumption (Table 1).

### **Power**

Ten studies conducted content analyses of the **extent** of brand and product unhealthy advertising, and its **appeal** to children, using general measures of popularity in brand or site selection. Most were content analyses of marketing strategies on Facebook brand or product pages (in the US, Thailand, Brazil, Australia, New Zealand and Egypt)<sup>40,66–69,71,72,74,75</sup>. Further studies assessed Instagram<sup>66,70</sup> and YouTube<sup>71</sup> marketing, including influencer content<sup>76</sup>. One examined marketing strategies on Facebook, Instagram, Twitter, Tumbler and Vine<sup>66,73</sup>, finding that interactive techniques were significantly more common in posts featuring adolescents<sup>66</sup>.

### **Potential or partial exposure**

A further seven studies carried out content analyses, having applied methods to identify or infer sites of particular appeal to children, or content more likely to reach them. A study in Ireland engaged in simulated Facebook ad buying to identify brand accounts with the greatest reach among 13-14-year-olds<sup>40</sup>. A UK study examined YouTube influencers popular with children<sup>76</sup>; a US study examined endorsements by music celebrities popular with teens<sup>80</sup>; and a Malaysian study assessed advertising on global YouTube channels with high child audiences<sup>77</sup>. A New Zealand study assessed marketing on websites most popular with children<sup>78</sup>; a US study assessed gaming websites popular with children<sup>81</sup>. Finally, a Swedish study of adolescents' Instagram user-generated content<sup>79</sup> demonstrated their engagement with advertising tropes.

**TABLE 1.** Studies illustrating research methods assessing food marketing in digital media

Author	Year	Country	Media	Power	Exposure	Consumption	Attitudes, Preferences	Description
Studies of marketing power in social media — based on food brands' general expenditure, social media followers, or sales								
Bragg et al <sup>66</sup>	2020	US	Instagram, Vine, Facebook, Twitter, Tumblr	√				Extent of social media marketing; content analysis of techniques of US fast food, beverage, snack brands with highest ad spend
Jaichuen et al <sup>67</sup>	2019	Thailand	Facebook	√				Content analysis of marketing techniques of 30 Thai food, beverage Facebook brand pages with most followers
Brownbill et al <sup>68</sup>	2018	Australia	Facebook	√				Content analysis of posts on 6 most popular sugar-sweetened beverage Facebook pages
Horta et al <sup>69</sup>	2018	Brazil	Facebook	√				Content analyses of 16 ultra-processed product Facebook brand pages from 250 most-liked brand pages (Brazil)
Vassallo et al <sup>70</sup>	2018	Australia (global brands)	Instagram	√				Content analysis of marketing strategies — 15 global brands of energy-dense, nutrient-poor products, based on global sales rankings, Instagram followers
Vandevijvere et al <sup>71</sup>	2018	New Zealand	Facebook, YouTube	√				Content analyses of popular New Zealand food, fast food, beverage sites on Facebook ('likes'), YouTube (subscribers)
Boelsen-Robinson et al <sup>72</sup>	2016	Australia	Facebook	√				Content analysis of 3 highest selling brands for fast food, confectionery and soft drinks, identified by global sales data.
Lauricella & Koster <sup>73</sup>	2016	US	Twitter	√				Content and thematic analysis of 1 Twitter handle: @gotchocolatemilk; elite athlete endorsement
Gaber & Wright <sup>74</sup>	2014	Egypt	Facebook	√				Content analysis of posts on 8 largest fast food chains (4 global, 4 local)
Freeman et al <sup>75</sup>	2014	Australia	Facebook	√				Content analysis of 27 Australia food and beverage Facebook brand pages with most followers
Studies of digital media marketing — sites based on aspects of child popularity								
Coates et al <sup>76</sup>	2019a	UK	YouTube Influencers	√	(√)			Content analysis of food & beverages in YouTube videos of 2 influencers popular with UK children
Tan et al <sup>77</sup>	2018	Malaysia	YouTube	√	(√)			Food and beverage advertising displayed on top 25 YouTube Channels (Kids' filter; using adult devices)
Vandevijvere et al <sup>78</sup>	2017	New Zealand	Popular websites	√	(√)			Content analysis of ads on websites (n = 110) most popular with children aged 6-17 years and websites (n = 70) of food brands that market most in other media
Holmberg et al <sup>79</sup>	2016	Sweden	Instagram	√	(√)			Content analysis of hashtag #14år ('14 years') and user-generated food content

Tatlow-Golden et al <sup>40</sup>	2016	Ireland	Facebook	√	(√)			Content analyses of food brand pages (n=18) with greatest reach among 13-14-year-olds, identified via Facebook ad buying process
Bragg et al <sup>80</sup>	2016	US	YouTube & Websites	√				Analysis of celebrity of food and beverage endorsements. Popularity with teens assessed via Teen Choice awards.
An & Kang <sup>81</sup>	2014	US	Gaming websites		(√)			Content analysis of advertising on gaming websites (n=131) most visited by children
Methods indicating aspects of actual exposure								
Kidd et al <sup>82</sup>	2020	New Zealand	Facebook		(√)			Participants' (n=34, 16-18 years) ad exposure on Facebook desktop (measured via browser extension).
Pollack et al <sup>83</sup>	2020	US	Twitch	√	(√)			Extent, marketing strategies of 238 unhealthy brands including chatroom messages. User streaming platform.
ASA <sup>57</sup>	2019, (2020)	UK	Websites, YouTube					Child-age 'avatar' crawled non-signed-in environments (e.g., websites, YouTube) to identify child targeted brand/product ads
Potvin Kent et al <sup>84</sup>	2019	Canada	Screen capture		(√)			Ads captured on social media (n=101, 7-16-year-olds) using 2 apps, each for 5 minutes, on their own devices
Qutteina et al <sup>85</sup>	2019	Belgium	Social media		(√)			1-week diary study, screenshots of food marketing exposures seen (n=21, 12-18-year-olds).
Potvin Kent & Pauze <sup>86</sup>	2018	Canada	Popular websites		(√)			Extent of advertising on adolescents' 10 most popular websites – pop-up, banner ads (purchased data)
Hyary & Harris <sup>87</sup>	2017	US	Food company websites		(√)			Food company website visits (6-17-year-olds), different ethnicities (purchased data)
Harris et al <sup>88</sup>	2016	US	Child avatars		(√)			Extent of advertising served to a Facebook avatar network, including 2 boys (13 years) who 'liked' food brands
Ustjanauskas et al <sup>89</sup>	2013	US	Children's websites		(√)			Extent of food, beverage advertising on popular US children's web sites (purchased data)
Surveys and associations								
Smit et al <sup>90</sup>	2020	Belgium	Survey			√	(√)	Self-reported consumption, influencer channel viewing (n=453; 8-12-year-olds). Longitudinal survey – 3 waves, 3 years.
Critchlow et al <sup>91</sup>	2020	UK	Survey				√	30 second ad video view. Attitudes on 8 measures
Baldwin et al <sup>92</sup>	2018	Australia	Survey			√	√	Self-reported consumption, Internet, social media use; engagement with brand content (10-16-year-olds)
Buchanan et al <sup>93</sup>	2018	Australia	Survey <i>Young adults, 18-24-year-olds</i>				√	Self-reported consumption; digital/other marketing and energy drink use.
Pettigrew et al <sup>94</sup>	2013	Australia	Brief survey				√	Viewing of 2 ads. Attitudes to products; 8-14-year-olds; parents
Experiments								
Murphy et al <sup>34</sup>	2020	IRL	Facebook				√	Eye-tracking attention; recall, recognition; social attitudes; sharing intent in social media (n=151, 13-17-year-olds)

Coates et al <sup>50</sup>	2019b	UK	Instagram			√		Healthy, unhealthy, non-food promotion by popular YouTube influencers and children's consumption (n=176, 9-11-year-olds)
Coates et al <sup>51</sup>	2019b	UK	YouTube Influencer			√		Influencer food marketing; 'protective' advertising disclosure impact on children's food intake (n=151, 9-11-year-olds)
Norman et al <sup>21</sup>	2018a	Australia	TV & online			√		4 times 6-day holiday camps (n=160; 7-12 years); children's self-regulation of eating and television and online food marketing (a) Parent feeding practices (b) sustained impact of TV, online food advertising
Norman et al <sup>20</sup>	2018b	Australia	TV & online RCT			√		
Buchanan et al <sup>95</sup>	2017	Australia	Online: <i>NB: 18-24-year-olds</i>			√		Online marketing, energy drink consumption (n=60, 18-24-year-olds)

Abbreviation: RCT, randomized controlled trial.

√ = **measured** ; (√) = **partially measured**

Nine studies employed methods indicating children's potential or partial exposure to advertising. Despite innovative designs, none could offer actual or comprehensive exposure assessments. A strong, technically sophisticated US study of **brands and chat on the user streaming site Twitch**<sup>83</sup> revealed very extensive exposure experienced by site users and a complex ecosystem of paid and user-generated advertising. The findings reflect exposure on just one site and this method requires complex skills to implement. A New Zealand study developed a **Facebook ad extension**<sup>82</sup> to record paid advertising delivered to study participants on their desktop computers. This method captures actual exposure on individuals' own accounts and devices. Desktop was chosen because creating extensions for mobile is technically challenging. However, advertising served in digital media is device-specific, and food and beverage advertisers favour mobile, native advertising; furthermore, as described in Part 1, advertising techniques (e.g., use of influencers) that are not recorded as formal paid advertising<sup>42</sup> are widespread in digital media. As a result, this extension is likely to capture only a limited portion of food marketing young people are likely to be served. In the US, researchers created a small interconnected group of **accounts**<sup>88</sup> or **'avatars'** in Facebook, two of which were registered as 13-year-old-boys, to identify unhealthy food marketing served to them. Such a study design demonstrates that accounts identified as children are served social media advertising for unhealthy items. However, genuine social media users engage with a wide range of content beyond food marketing pages, and typically have many 'friends'. There is therefore very strong competition for access to a users' feed, which is controlled by complex Facebook algorithms<sup>5</sup>. Therefore, simple mocked-up accounts such as these, of brief duration with limited contacts and content, cannot generate measures of children's real-world exposure to food marketing.

A study of **social media diaries**<sup>85</sup> in Belgium, in which young people send screenshots of marketing they see, improves on recall-based diary design, reducing reliance on retrospective recall and showing that actual young people receive advertising for unhealthy foods. However, identifying actual exposure with this method requires sustained participant engagement; it is important to note that much advertising is processed subconsciously<sup>29</sup> and is therefore less likely to be actively observed by participants. Two studies bought records of **advertising served on children's preferred websites**<sup>86,87,89</sup>. This has the benefit of assessing actual advertising on sites of interest to children, but entails considerable expense and substantial investment in data management and analysis. Furthermore, these do not assess social media, gaming sites, or media sharing sites, thus reflecting a limited sample of children's activities. A further US study using **purchased data compared children's internet activity by ethnicity**; it found Hispanic children, although less likely to access the internet, were more likely than non-Hispanic children to access food/beverage company websites, suggesting analyses of such websites may continue to be of value in some regions<sup>87</sup>. **Web-crawling 'avatars'**<sup>57</sup> identify advertisements served to accounts identified as children on open-access sites such as websites and YouTube. However, this method cannot identify extent of actual children's exposure on these sites, nor can it access internet environments that require signing in to participate, such as social media and other settings.

Finally, of all the exposure methods, **screen capture**<sup>84</sup> is the most naturalistic, recording children's use of preferred media on their own devices, where their interests and history define the advertising they receive. At present, screen capture is the method of choice, yet it also presents validity, cost and ethical challenges. Current versions record a snapshot of just a few minutes, and/or use expensive materials (e.g., eye-tracking glasses) and consume extensive researcher time for coding

and analysis. Screen capture via installed apps is possible, but our experience is that ethical issues (encountering sensitive and/or inappropriate data), uptake and sustained participation are presenting challenges. Still, this remains the most promising approach. As methods continue to be developed, we expect screen capture will generate closer approximations of children's actual food marketing exposure.

### **Impact of digital marketing on attitudes and behaviours**

The focus of this review was on methods to assess exposure and power. However, we included an emergent body of evidence (11 survey, correlational and experimental studies) demonstrating that, as shown in systematic reviews of television food marketing, digital food marketing affects children's attitudes and behaviours, including consumption. In Ireland, adolescents' ad attention duration, brand recall and recognition, likelihood to share profiles and evaluation of peers were all greater for social media profiles with unhealthy food ads, compared to those with healthy food ads or non-food ads<sup>34</sup>. UK studies of children's YouTube video viewing of influencers promoting foods demonstrate effects on food consumption<sup>50,51,90</sup>. In the naturalistic setting of a summer camp in Australia, TV and online ad exposure led to enough daily increased calorie consumption to cause overweight over time<sup>20,21,96</sup>. Online survey studies with adolescents in Australia and the UK have correlated digital media use (self-reported media or platform use, and brands engaged with), or responses to food ads, with self-reported eating<sup>91,92</sup>.

Finally, although the body of studies assessing food company websites and advergames was not included in this review, we note that a meta-analysis of food marketing advergames concludes that encountering embedded branding or advertising within content such as games influences children's subsequent food consumption<sup>97</sup>. Furthermore, where data indicate that children frequently access food company websites and/or advergames, we recommend that studies are conducted to measure likely exposure and power (accordingly, the protocols described in Part 3 provide appropriate guidance).

## **Part 3: WHO/Europe Protocols<sup>98</sup> to assess exposure and power of unhealthy food marketing to children**

This review has identified extensive challenges when monitoring the exposure and power of food marketing in digital media; the few studies available to date, their methodological innovations and limitations. Of note is the lack of consistency across studies in how exposure and power are coded, making comparability across regions, countries, or pre- and post-regulation difficult or impossible. Yet, like data from the WHO European Childhood Obesity Surveillance Initiative (COSI), data on digital marketing to children should be comparable across countries (Breda J et al, Mobilizing governments and society to combat obesity: Reflections on how data from the WHO European Childhood Obesity Surveillance Initiative (COSI) are helping to drive policy progress. *This issue*).

### **The CLICK Framework and the WHO/Europe Protocols**

The WHO Regional Office for Europe published CLICK in 2019<sup>14,52</sup>. This overarching framework was generated by the findings of expert workshops in 2016 and 2018 facilitated by the WHO Regional Office for Europe<sup>13,14</sup>. At these workshops the present authors and other public health experts and researchers — from the fields of psychology, food marketing, online marketing, technology, law and

ethics — identified challenges and solutions to monitoring children's digital marketing exposure. CLICK sets out five key steps that policymakers and researchers can engage in to assess digital marketing to children. However, the detailed methods required to apply several of CLICK's principles are currently nascent or in development.

Previous monitoring protocols (see Consumers International, 2011<sup>99</sup>; INFORMAS group, 2013<sup>100</sup>; World Health Organization 2016<sup>101</sup>; Nordic Countries, 2018<sup>102</sup>) demonstrate the need for comprehensive tools and methodological consistency. Yet media and children's practices change over time, as does the advertising ecosystem. Protocols with variables and methods tackling the digital ecosystem are lacking. Furthermore, children's media practices vary with age and by location, as do brands and products most likely to target and reach children and young people.

Our experience in introducing public health experts in many countries to the features and challenges of digital marketing since 2015 led us to identify the need for a detailed set of resources that could introduce colleagues to the issues, support decision-making in the face of this wicked problem, and offer step-by-step guidance for monitoring of digital and television food marketing. Therefore, drawing on our expertise in carrying out international monitoring studies in both television<sup>60,103</sup> and digital media<sup>40,76</sup>, and protocol development<sup>101,102</sup>, three of the present authors (MTG, JJ, EB) engaged in an iterative process to arrive at a consensus set of guided steps and key variables to measure. The aim is to generate replicable and comparable findings in digital media studies as well as television. The resulting set of WHO protocols is available on the website of the WHO Regional Office for Europe: <https://www.euro.who.int/en/health-topics/disease-prevention/nutrition/activities/monitoring-of-marketing-of-unhealthy-products-to-children-and-adolescents-protocols-and-templates>. These include detailed preparation stages, in particular for digital media studies, and step-by-step guidance on systematic variables and methods to ensure more coherence in global study design. Building further on variables applied in a WHO television food advertising study<sup>101</sup>, coding templates and step-by-step guidance support capacity-building in research teams. The focus is on technically straightforward, low-cost methods (e.g., content analyses of Facebook brand pages).

Table 2 outlines the CLICK Framework steps that can be answered with methods in the protocols (including those in development). This is a set of living documents supporting researchers to meet several goals of CLICK. It will be updated as media and methods evolve, and as researchers learn from the observations of implementing countries. At the time of writing, these tools are currently being applied in studies in the WHO European Region, Latin America and South-east Asia.

**TABLE 2.** WHO CLICK Framework and new WHO protocols and templates

<b>CLICK<sup>14,52</sup> Framework &amp; goals</b>	<b>WHO Protocols and templates: step-by-step guides (V2 2020)</b>	
<b>Comprehend</b> the digital ecosystem	<b>Internet Monitoring Guide Introduction</b>	Introduces reader to key issues in monitoring digital media, including methodological and ethical challenges
	<b>Getting ready</b> Understanding children's media practices and key relevant products and brands <b>Prep Step 1</b> Which digital media do children use in your country/region? <b>Prep step 2</b> Which are key food and beverage products and brands in your region?	This section provides a set of options for assessing local media practices and the relevant items on which an analysis should focus. It introduces researchers to methods by which they can approach assessing these, depending on the data sources and research resources available to them. Furthermore, two slidecasts ( <a href="https://euro.sharefile.com/share/view/sd4e5f7899704277b">https://euro.sharefile.com/share/view/sd4e5f7899704277b</a> ) introduce the psychology, development and marketing theory and evidence underlying food marketing monitoring and research.
	<b>Marketers' and brands'</b> marketing campaign reports	A brief introduction to the value of analyzing marketing campaign reports for insights into marketers' strategies
<b>Landscape</b> of campaigns	<b>Content analyses (with templates and step-by-step protocols)</b> <b>YouTube brand channels:</b> ad videos <b>YouTube: social media influencers</b> <b>Brand/product websites</b> <b>Social media sites:</b> brand pages	This section introduces researchers to methods to content analyse YouTube channels (including influencers), websites, and social media such as Facebook. Includes excel templates for gathering data on nutrient profiles and exposure and power variables
<b>Investigate</b> exposure	<b>Children's websites:</b> purchased data	A brief introduction to benefits and limitations
	<b>Social media sites:</b> proportionate reach via simulated ad buying	Step-by-step guidance to assessing comparative 'reach'
	<b>Passive metering</b>	At time of writing, this protocol is in final development. It will provide a template for metering methods e.g., a virtual private network (VPN) installed on users' devices to collect advertising
	<b>Television exposure</b>	The protocols also contain detailed templates and guidance for television advertising
<b>Capture</b> on-screen	<b>Recording screen use</b>	Outline method and ethical advisory are currently available. Protocol and templates in development
<b>Knowledge</b> sharing	<b>Analysis and writing guides</b>	Support for simple statistical analyses and writing up of monitoring studies (reports, peer-reviewed articles)

## Conclusion and Recommendations

There are grave imbalances in access to information between, on the one hand, 21<sup>st</sup> century commercial digital media platforms, advertisers and other actors; and on the other, policymakers, researchers, public health and civil society. In a highly complex, largely inaccessible domain, this review has identified existing methods that assess aspects of children's exposure to food marketing and its power. Automated methods are expensive and complex to develop, so collaborative approaches are required. New WHO Regional Office for Europe protocols support researchers to carry out (largely) manual content analyses and, importantly, they identify key variables to measure. These provide a global baseline for assessing food marketing power and children's exposure. This will allow for replicable and rigorous studies of children's food marketing exposure, to make the internet a safer place for children to learn and explore without inappropriate advertisements harming their rights to health, privacy and freedom from exploitation.

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