**Abstract**

**Context:** Young people are exposed to an abundance of advertising for unhealthy products (e.g., unhealthy foods, tobacco, alcohol). Due to their developing cognition, children may not be able to understand the intent of advertising. However, advertising restrictions often assume that adolescents have critical reasoning capacity and can resist the effects of advertising. This review seeks to assess whether the evidence supports this assumption.

**Objective:** Review evidence relating to advertising and young people’s critical reasoning abilities (understanding and attitudinal responses to brands/products).

**Data sources:** Ten databases were searched in December 2020.

**Study selection**: Inclusion criteria were participants aged 6-17 years, any advertising exposure, objectively measured understanding or attitudinal outcome, a comparison/control/between-group comparison. Included all languages, excluded studies published pre-2010.

**Data extraction:** Two reviewers independently extracted data and assessed study quality.

**Results:** Thirty-eight articles were included. Meta-analysis of nine studies with attitudinal outcomes indicated that unhealthy product advertising generated more positive brand/product attitudes compared to neutral/no advert control in all ages. Significant effects for digital and non-digital advertising formats. We found greater understanding did not protect against the impact of advertising on brand/product attitudes.

**Limitations:** Unable to meta-analyse the impact of advertising on understanding or the influence of age.

**Conclusions:** Evidence shows that the attitudes of young people were influenced by advertising. Critical reasoning abilities did not appear to be fully developed during adolescence and not found to be protective against the impact of advertising. Policymakers should ensure regulations to restrict marketing of unhealthy commodities protects adolescents as well as younger children.

**Introduction**

Young people are exposed to an abundance of advertising and marketing, primarily for toys and food products (mostly high in fat, salt and sugar; HFSS).1-4 Advertising can lead to behaviour change through direct and indirect pathways, which leads to harm through unhealthy behaviours.5 The hierarchy of effects model suggests that advertising creates awareness of and interest in a brand/product, which leads to heightened preference and then to a decision to purchase and consume.6 Much of the advertising children are exposed to is for potentially harmful products (e.g., HFSS food, alcohol) which may increase unhealthy behaviours, which are associated with a number of detrimental and harmful effects.7,8 Direct tobacco advertising is banned in most countries, but young people are still exposed to indirect advertising, for example, through viewing tobacco use on television (TV), shown to result in smoking initiation in young people.9 Electronic cigarettes (e-cigarettes) have also grown in popularity over the last decade, and pro-vaping advertising are prevalent on social media, with emerging evidence of harm.10,11 Research on the impacts of advertising on children over the past decade has focused particularly HFSS food advertising.12 Young people are exposed to large amounts of food advertising through various media, which is often child-targeted and mostly for HFSS foods.13,14 Meta-analyses show that food advertising increases acute calorie intake in children.15,16

There has been a strong policy focus on tightening regulations around food advertising, although restrictions frequently only apply to children up to 12 years of age.17 There are widespread restrictions to prevent alcohol and tobacco advertising that targets children; since these products are illegal for children to purchase or use,18 with calls to make these restrictions worldwide to address noncommunicable diseases.19 Researchers have raised concerns over the ability of children and young people to identify, understand and apply critical reasoning in response to advertising. Thus they are more susceptible to the influence of advertising, especially in digital formats (including embedded content on webpages, social media platforms and advergames), making this a policy target and active research area.20

There is substantial literature on the understanding of advertising. A prominent framework has been the ‘Persuasion Knowledge Model’ (PKM), which proposes that to resist advertising, individuals must first recognise that an advert is trying to sell something (persuasion knowledge).21 Various aspects of understanding have been identified: recognising advertising; perception of who pays for advertising and audience targeting; understanding the selling intent of advertising (i.e., that advertisers are trying to sell products), persuasive intent (i.e. ,that advertisers are trying to influence behaviour via changing attitudes towards products/brands), tactics (i.e., specific strategies used), and bias regarding the product (i.e. discrepancies between advertised and actual product).22 Evidence suggests that ‘advertising literacy’ (i.e., knowledge and understanding of advertising intent and tactics) does not fully develop during childhood; therefore, children do not possess the necessary cognitive ability to resist advertising.22,23 For this paper, we view critical reasoning as the ability to recognise and understand advertising (advertising literacy) and how it impacts children and young people’s response to advertising. Much of the work around children and advertising, and children’s broader position as consumers, has been informed by Piagetian theory, which presents age-specific stages in children’s development driven by cognitive ability.24,25 This suggests progressive growth in understanding, showing that as children get older, cognitive ability increases along with an increased ability to understand and resist advertising. This understanding was largely developed when TV was the main advertising medium, but the applicability to the digital age of advertising has been questioned (even for older children), as entertainment and advertising content are not clearly distinguished.26

Social-cognitive models present the effects of advertising occurring automatically without any information processing, suggesting that understanding alone is insufficient to counteract the potentially harmful effects of advertising.25 Concerning food, the Food Marketing Defense Model posits that awareness, understanding, ability (including cognitive capacity), and motivation (to resist advertising) are all required to withstand food advertising.25 Advertising, especially when digitally embedded, is designed to bypass conscious and rational decision-making and instead rely on emotional responses and non-conscious processing, thereby inhibiting the ability to resist effectively.27,28

Reasoning abilities are not fully developed by the age of 16, older than the 12-year threshold used in many regulations; other faculties associated with decision-making also continue to develop into adulthood.29 It is established that teenagers engage in riskier behaviour than both children and adults, attributed in part to changes in reward sensitivity occurring from early adolescence and the later development of self-regulatory competence.29 In addition, they may be particularly susceptible to the social influence of their peers.30 This evidence may be relevant to young people’s critical reasoning of advertising, since developmentally, they may not be cognitively equipped to protect themselves from the potentially harmful effects of advertising. Studies indicate that children of all ages have difficulties identifying digital marketing.26,27 Adolescents are particularly vulnerable to digital advertising due to their engagement with digital technology and media, which plays an important role in their social identity development.17,27

Existing reviews and meta-analyses have shown that children of all ages are impacted by advertising,13-16 but the notion that understanding of advertising and older age are sufficiently protective remains pervasive. This review focused on two areas of interest; the *ability* of young people to recognise and understand advertising and how they *respond to* advertising in terms of attitudes towards the advertised brand or product (i.e., the impact on diet and attitudes). The review aimed to explore whether evidence supports the notion that critical reasoning ability affects behavioural responses and how this may differ across childhood and adolescence. Critical reasoning relates to the former, but response is likely to include broader factors which could impact on what decisions young people make and their subsequent behaviour. For example, attitudes to the advertised product or brand and level of motivation to resist the impact of advertising exposure.

**Methods**

We conducted our systematic review using EPPI-Reviewer 4 software.31 The study was pre-registered with PROSPERO (CRD42018116048), and the systematic review is reported in accordance with the PRISMA checklist.32

Search strategy, eligibility criteria and information sources

The search strategy was created in collaboration with an information specialist (CS). The search was based on terms for population (children and young people), intervention (e.g., marketing, advertising, advergame\*), and a measure of ‘understanding’ or ‘attitudes’ (e.g., reasoning, psychology, advertising literacy, cognition). Systematic searches of the following databases were conducted: ASSIA (Proquest), Child Development and Adolescent Studies (EBSCO), Cochrane Central Database of Controlled Trials, Medline (OVID), PsycINFO (OVID), Sociological Abstracts (Proquest), Social Policy and Practice (OVID) and SCOPUS, and Web of Science – databases (Social Science Citation Index, Emerging Sources Citation Index). The full search strategy is included in a supplemental file (Table S1 and Table S2). Searches were conducted on 7th November 2018 and updated on 10th December 2020. The search results were imported into Endnote reference manager software and duplicates removed. The remaining articles were imported into EPPI-Reviewer 4 software and duplicate records screened and removed; this software was used to manage the screening.

The focus of the review was initially broad, as the scope of the literature was unknown. Following the initial search, a mapping exercise was undertaken to determine the full-text inclusion criteria. A decision was made to focus on experimental studies with an administered exposure (see Supplementary S3 for full details of this initial stage and mapping diagram).

Eligible for inclusion during full text screening were: studies with participants aged 6-17 years of age inclusive; intervention criteria of any form of advertising for any product (including HFSS products, tobacco, toys); and outcomes of objectively measured understanding (including recognition or identification of advertising, understanding selling or persuasive intent) or attitudes (towards brand or product including liking or perceptions). Experimental and intervention studies, including randomised or quasi-randomised studies, were included and required to have an appropriate comparison or control group, including no advert, a neutral advert, or a between group comparison (age, gender, socioeconomic status (SES)) with an advert exposure. Neutral adverts were defined by the studies and included adverts that were not the focus of the study e.g., a toy/non-food advert for studies with a food advertising exposure and food product outcome. Studies were included from 2010 onwards as these were considered most relevant to contemporary advertising practices. There were no restrictions by geography or language. Exclusion criteria were date (pre-2010), intervention (any exposure that evaluated health promotion prevention programmes, charity advertising, creation and testing of models of cognition, media training/ advertising literacy, branding only), outcome measures (any non-understanding/ attitude measures including dietary intake or purchases), study design (qualitative studies, reviews, and dissemination format (non-peer reviewed e.g., dissertations, conference abstracts, magazine abstracts). A random sample of studies were double-screened by two reviewers (HC & JP) on title and abstract using EPPI-Reviewer 4 software. All screening queries were reconciled by the reviewers. We used the machine learning capabilities of the EPPI-Reviewer software to assist with the screening due to the anticipated number of records from test searches (over 10,000). We employed an ‘active learning approach’, where the prioritisation of records was frequently refreshed so the most relevant articles were screened first. The algorithm was trained using our screening decisions. Articles screened were plotted against studies included, and this was used to indicate when to stop screening (i.e., the rate of inclusion plateaued indicating that there were unlikely to be unscreened relevant articles). A classifier model was then created and applied to all unscreened records, with a score based on relevance (0-100) generated and used to double-check exclusion. For full details on the machine learning approach and updated search methods see Table S4 and the following reference.33 Full-text screening was then independently completed by the same two reviewers (HC & JP) using EPPI-Reviewer 4 software and queries were jointly reconciled.

Data extraction

Descriptive data were extracted by one reviewer (JP) and checked for accuracy by another reviewer (HC). Data from experimental studies for inclusion in meta-analyses were independently extracted by two authors (JP & HC) and any discrepancies resolved by re-extraction. Corresponding authors were contacted to provide raw data where necessary; 15 authors were contacted for additional information and nine provided additional data, six did not (one was contacted regarding understanding outcomes only).

Assessment of quality

Risk of bias for the experimental studies was assessed by two reviewers (HC & JP) using Cochrane methods,34 either RoB 2.0 for randomized trials35 or ROBINS-I tool for non-randomized studies.36 To assess publication bias, funnel plots were created to assess asymmetry using Egger’s test.37

Data synthesis

For inclusion in meta-analyses for understanding of advertising or brand/product attitudes, studies were required to compare the effect of an unhealthy product (e.g., food, alcohol, tobacco) advert exposure to a non-advert control, or to a control advert (advert for unrelated products).

Studies measuring attitudinal outcomes were required to have mean values with standard deviations. Due to differences in reported outcome measures, which included a variety of different scales (e.g., 1-5, 1-3, dichotomous), the DerSimonian-Laird random-effects model was used to allow for synthesis of studies and standardized mean difference (SMD) was used as the outcome for the meta-analyses. All analyses were conducted using Stata 16 (16.1, StataCorp LLC, College Station, TX, USA).37 Further details of how advert exposure conditions were combined, the outcome measures and scales and criteria for inclusion in the meta-analyses are provided in a supplemental file (see Table S5).

Two meta-analyses comparing an advert exposure to control or neutral advert were conducted, by attitude type (brand or product) and by advertising format (digital or non-digital). For this review we define brand attitude as the attitudes toward the advertised brand and product attitude as the attitudes toward the advertised product. Digital advertising formats included advergames, webpages, social media platforms and influencer marketing, while non-digital advertising formats included TV and printed adverts, and product placement on TV or in movie clips. For all studies except one,38 a single combined advert exposure group was calculated for each group using Cochrane methods.39 The exception was a study where three separate data points were included with the advert exposure of a specific product matched to the specific product attitudinal outcome measure.38 We additionally conducted meta-analyses examining the impact of advertising on attitudes by age (children ≤12 years, teenagers >12 years due to legislation cut-offs).

Narrative synthesis

Findings of studies not included in the meta-analysis are reported narratively, presented by outcome (understanding or attitudinal) and by impact of age and advertising features.

**Results**

Study selection

The database searches yielded 15,656 papers, resulting in 9,325 studies once duplicates were removed. A random subset of 1,790 studies were screened on title and abstract to trigger the machine learning from the original search and a further 208 screened on title and abstract from the updated search. Screening on title and abstract ultimately resulted in 272 studies to be screened on full-text and assessed for eligibility. This resulted in 39 studies, from 38 articles, which met the inclusion criteria. Nine of the studies that reported an attitudinal outcome were included in the meta-analyses (Figure 1).

**[Figure 1 here]**

Study description and results

A summary of the descriptive data is provided in Table 1 including details on setting (country, study), participants (sample size, age details), design, advertising exposure, outcomes measures, and findings.

Participant ages ranged from 4 to 18 and were broadly categorised as 12 years and under (n=19),38,40-53 over 12 years (n=7)54-60 or had participants in both age groups (n=13).61-76 Most of the studies were conducted in Europe (n=16; Austria n=5, Netherlands n=4, Belgium n=3, UK n=3, Portugal n=1), followed by the United States (n=12), Australia (n=6), Chile (n=2), and Israel (n=1), India (n=1), South Korea (n=1). Studies were mostly conducted in classroom settings (n=21). Advertising exposure was most commonly for food (n=29; all included a HFSS product or brand e.g., fast food or sugary cereal; in addition to some non-HFSS products), followed by e-cigarettes (n=7) or an assortment of products (n=3, including games, banks and a financial services company). Majority of the advertising exposures were non-digital (n=25, including TV adverts, product placement, print advert, TV sponsorship or movie trailers), compared to digital (n=18, including advergames, banner/pop-ups, social media). Outcomes, related to the advertised product, measured either understanding (n=10, e.g., identification of commercial content, selling intent, persuasive intent, perceived advertising intentions) or attitudinal (n=23, e.g., product liking, product perceptions, perceived benefits, appeal) or studies that measured both (n=13).

Narrative synthesis of understanding outcomes

Meta-analysis was not possible for understanding measures, owing to the heterogeneity of exposures and outcomes for relevant studies. Many studies had control groups where, due to the nature of the questions, understanding of advertising was not able to be assessed (i.e., cannot assess understanding about an advert the group did not see).

Impact of age on understanding

Where compared across age groups, understanding of advertising increased significantly with age (eight studies, mostly assessed as some concerns of bias and one as low risk of bias),40,41,45,47,48,50,63,75 although no significant effects were found in four studies (mostly assessed as having some concerns of bias and one as low risk of bias),46,49,67,68 and understanding decreased with age (assessed as low risk of bias).76 Most of these studies were conducted with children under 12 years, so evidence was limited for teenagers. Of two studies conducted with teenagers, one study assessed as having some concerns of bias directly compared children aged 9, 12 and 15 years and found that advertising recognition significantly increased as age increased;75 the other study assessed as low risk of bias found 12-14 years olds had significantly higher recognition of sponsored content in a YouTube video compared to 15-16 year olds, but there was no significant difference between age groups for understanding persuasive intent.76

Impact of advert content on understanding

One study with some concerns of bias reported that persuasion knowledge increased with higher brand integration (in relation to advergames) but persuasion knowledge was very low across all groups and the magnitude of differences modest.48 In relation to child ‘involvement’ with advertising (i.e. engagement with advergame), one study with some concerns of bias showed that children more involved with an advergame were less likely to identify commercial content.49 One study with low risk of bias looked at differences in recognition of commercial content in advergames between a familiar HFSS brand and a fictitious or unbranded pizza game and found that recognition of the familiar brand was significantly greater than the unbranded game.59 A similar study with some concerns of bias assessed persuasion knowledge between a branded advergame and a non-commercial advergame and found no significant difference.53 Seven studies of mixed bias assessments (four some concerns, three low risk) measured different types of understanding, four found that awareness of selling intent was higher than persuasive intent in children aged 4-12 years (two were significant;40,46 two did not test significance);47,49,63 two found recognition of advertising in 7-16 year olds was greater than understanding persuasive intent76 or advertising literacy;45 lastly, one found skeptical attitudes towards advertising were greater than recognition of advergames as advertising, due to very low recognition in 7-11 year olds (62.5-72% vs 48.5%).50 Four studies with some concerns of bias measured the impact of advertising format and found significantly greater understanding with non-digital advertising (TV) compared to digital advertising (primarily advergames).47,49,63 Overall, understanding of the persuasive intent of adverts to impact on attitudes and behaviours was generally low across studies, for example, only 40% in 11-12 year olds,40 and only 1% of 7-9 year olds and 12% 10-12 year olds.45

Meta-analyses of attitudinal outcomes

A meta-analysis, comparing all advert exposures to no advert or neutral advert control by attitude type (Figure 2), showed that overall, any advertising exposure significantly increased positive attitudes toward the brand or product, SMD = 0.397 (p = 0.001; 95%CI 0.154, 0.639; I2 = 91.4%). The subgroup meta-analysis by attitude type also showed that the effect of an advertising exposure was significant for both product attitudes (SMD = 0.430 (p = 0.014; 95%CI 0.087, 0.774; I2 = 85.7%)) and brand attitudes (SMD = 0.369 (p = 0.049; 95%CI 0.001, 0.736; I2 = 94.0%)).

A meta-analysis exploring the effect of advertising by format (Figure 3), showed overall that any advert significantly increased positive attitudes, compared to no advert or neutral control, SMD = 0.36 (p = 0.009; 95%CI 0.14, 0.58; I2 = 91.2%). When examined by advertising format, both digital advertising exposure and non-digital advert exposures had a significant positive effect on attitudes, SMD = 0.35 (p= 0.005; 95%CI 0.01, 0.068; I2 = 93.2%) and SMD = 0.36 (p = 0.005; 95%CI 0.08, 0.65; I2 = 84.5%), respectively. Egger’s regression analysis found no evidence of bias for either meta-analysis, although funnel plots showed some evidence of asymmetry (Figure S6 and Figure S7). Trim and fill analysis showed no strong evidence of missing studies for either meta-analysis (Figure S8 and Figure S9). Sensitivity analysis was completed running a fixed effect model, none of the findings changed in significance in either direction.

An additional meta-analysis was conducted which looked at the impact of advertising on attitudes by age (Figure S10). Advertising had a positive impact on attitudes compared to the control condition for both age groups (i.e., >12 years and ≤12 years). A further meta-analysis was carried out as a sensitivity analysis (Figure S11) to explore whether the effect held when the largest effect size was removed and the effect was still seen.

**[Figure 2 here]**

**[Figure 3 here]**

Narrative synthesis of attitudinal outcomes

The majority of controlled studies not suitable for meta-analysis supported the above findings, namely that adverts brought about more positive attitudes (7 studies, mixed bias assessments: three low, three some concerns and one high);42,43,48,49,54,55,60 however, five studies found no significant differences between groups (mixed bias assessment: three low, two some concerns).52,58,59,70,74 One study, assessed as having a high risk of bias, explored the impact of e-cigarette adverts designed with low and high youth appeal and found the low youth appeal advert resulted in more positive attitudes than a non-e-cigarette control advert, but there was no difference between the high youth appeal and control adverts.57 One study, assessed as low risk of bias, found that the younger group (5-6 years) had significantly more positive product attitudes following exposure to TV advert for HFSS cereal compared to the older group (10-11 years).51 Another study with some concerns of bias found that brand preference following exposure to product placement decreased significantly with increasing age (9 vs 12 vs 15 years).75

Two studies with low risk of bias examined the impact of glamorised e-cigarette advertising on perceptions of cigarette smoking or e-cigarettes, compared to neutral or no advert control. They found the adverts led to occasional cigarette smoking being perceived as less dangerous and harmful64,72 and the use of e-cigarettes by children as being more common.64 One also found there was no difference in the appeal of e-cigarettes between adverts that glamorised e-cigarettes compared to adverts that associated e-cigarettes with health.64

Impact of understanding on attitudinal outcomes

Seven studies measured the interaction between understanding and attitudinal outcomes and reported interactions. Five studies found no interaction, showing that greater understanding of advertising did not limit favourable attitudes towards the advertised product45,48,49,59,66 and two found some evidence of an interaction.63,68 Six of these studies were found to have some concern of bias, the other was assessed to have low risk of bias.59 This study found for children aged 13-18 years, recognition of commercial intent had no effect on brand attitude for either an unfamiliar or familiar brand. The age range for children from studies that found no interaction was broader than those that found interactions (5-18 vs 7-14 years). Of the two studies that found an interaction between lack of persuasion knowledge and greater attitudinal outcomes, the first had online pop-up adverts, which are heavily embedded, as the advertising exposure,73 while the second only found an interaction among children that understood the snack was unhealthy (the interaction was not observed if children thought the advertised snack was healthy).68

Quality assessment

For non-randomised studies, two were rated as low and 11 as moderate risk of bias (Figure S12). Moderate risk of bias was mostly due to the domain ‘bias due to confounding’, as not enough information was provided, or confounding variables were not included in analyses. Of the randomised studies, 10 were rated as low risk of bias, 13 as some concerns and three with high risk of bias (Figure S13). The studies with some concerns were mostly due to lack of detail about the randomisation process or unreported information about the selection of the reported results. Results were consistent between studies rated as low to high risk of bias. Sensitivity analyses were run excluding studies rated as high risk from the meta-analysis (Figure S14). The overall impact of advertising on attitudes remained but product attitude sub-group was no longer significant.

**Discussion**

In this systematic review, data suggested that children’s understanding of advertising intent was limited and not nuanced i.e., children could recognise that adverts intended to sell a product but not that these were intended to change their attitudes and behaviour. There was limited evidence that understanding increased with age, but more research is needed in this area. Understanding was lower for digital compared to non-digital formats, and lower when children were more involved with the medium (e.g., advergames or online advertising). In terms of attitudes, meta-analyses indicated that advertising brought about more positive attitudes to both brands and products compared to controls; this was observed across all age groups. There was no evidence that adverts with high ‘youth appeal’ were more effective, but evidence was limited for these exposures. Findings suggested that greater understanding of advertising is not protective, with evidence that attitudinal outcomes were impacted positively regardless of level of understanding. These findings collectively indicate that advertising impacts children, regardless of age, level of understanding, format, or specific targeting/youth appeal.

Our findings indicate that children and young people of all ages have some difficulties in understanding advertising. This fits with the developmental perspective that young people’s critical reasoning abilities continue developing into late adolescence.29 We found that greater understanding does not necessarily protect against advertising, consistent with the Food Marketing Defence Model which challenges the focus on understanding to counteract the effects of advertising. The model instead proposes that advertising influences young people without conscious processing and that motivation to resist is also required, which may be lower among young people.25 We did not include disclosure or media literacy intervention exposures in this review, but our findings suggest that the inclusion of disclosures (e.g. declarations stating “this is an advert”) or media literacy training designed to increase understanding/advertising literacy would not necessarily protect children and adolescents from the influence of advertising.77 This is supported in the literature, one experiment found that children who viewed food marketing with a disclosure actually consumed significantly more of a marketed snack than a control group.77 A study in adolescents found that disclosures did not mitigate persuasion and increased brand memory, despite increasing understanding of persuasive intent.78 Media literacy programmes are a strategy often suggested by the food and beverage industry to increase persuasion knowledge in children, in lieu of improved regulations, such as industry-funded Media Smart (see <https://mediasmart.uk.com/>).79,80

Our findings that advertising had a positive impact on attitudes are consistent with previous research on food advertising.12,14,81,82 Further supporting these findings, adverts (TV and advergames) for ‘unhealthy’ unfamiliar food products have been found to elicit positive attitudes in children (aged 7-12 years); to a greater extent with advergames compared to TV advertising.83 We found effects on attitudes regardless of age, consistent with other studies in different age groups. There is evidence that pre-school children exposed to adverts for a range of child-directed foods had positive attitudes about these foods,84 and that adolescents reported positive attitudes after viewing online adverts for fast food and confectionery.85

Comparing digital and non-digital advertising formats, we found no difference in impact on attitudes in sub-group meta-analysis, but narrative synthesis indicated that understanding was lower for digital formats. This is unsurprising since digital advertising is more integrated and therefore may be less explicit and more difficult to identify and understand, in addition to greater personalisation and targeting.21,25 This is important given the ubiquity of these formats, especially for adolescents, who due to their extensive engagement with digital media with less supervision may be more susceptible to digital advertising.86 For adolescents, media plays an important role in their social identity development, as they place more value on the opinions and actions of peers and figure out their perception of how they fit with others.17,18,27 Digital marketing, especially on social media, is designed to target these unique developmental vulnerabilities.87

Implications

The findings from this review support understanding not being fully developed during childhood or adolescence. We also found that advertising influences the attitudes of young people of all ages, suggesting a need to protect older as well as younger children. Our results suggest that understanding does not protect children from the harmful impacts and influence of advertising, as per the Food Marketing Defense Model.25 Reducing exposure to advertising is therefore likely to be more effective than improving understanding through disclosures or media literacy training. Existing regulations typically only apply to children up to 12 years of age, as they have historically been regarded as more vulnerable to advertising and therefore needing greater protection.88 Our findings do not support lesser restrictions for advertising to teenagers, as there is no distinct evidence-based threshold for understanding that supports a cut-off of 12 years, and suggest that appropriate protection from advertising exposure would benefit all young people.17

Limitations

The limitations of this review include a lack of suitable data/studies to meta-analyse the impact of advertising on understanding or the influence of age. Meta-analysis limitations include the high heterogeneity of studies, despite using a random effects model and standardised mean difference outcome. The machine learning method has limitations, as a large number of articles were excluded without screening on title and abstract. The majority of the included studies were assessed as having some concerns of bias, which needs to be taken into consideration when interpreting the findings. Although sensitivity analyses removing studies with high risk of bias and the largest effect size were conducted and not found to impact results. We may not have identified all product placement exposure studies, as this term was not included in our search strategy; however, studies with advert or marketing key words were included. Some of the studies may have been conducted in the same or similar group of participants (Tarabashkina;66-68 Duke and Farrelly;54,55 Uribe;70,75 van Berlo;58,59 Castonguay41,51), but these do not interfere with the meta-analysis as only one was included. The time since the searches were completed is a limitation, with original searches completed in October 2018 and then updated in December 2020. This subject area is complex, so the review process is time intensive. Updating the searches would be low yield as the substantive findings of the work remained unchanged following the update searches and we have no reason to believe the main findings of the paper would be subject to change. The main strength of the paper is that it meets an evidence gap, specifically addressing if children over 12 years of age have critical reasoning capacity and can therefore resist the effects of advertising. We were also able to quantitatively assess the impact of advertising on attitudinal outcomes. The search was carefully planned and executed, with double screening and data extraction. Studies were contemporary, adding to the relevance for current policy. Due to the delay observed in research, we found fewer studies using digital advertisement exposures, which is an area where more primary research is needed. There is also a need for further primary research in teenagers, in relation to critical reasoning and advertising, especially digital formats.

**Conclusion**

This systematic review and meta-analysis provide evidence that advertising impacts upon the attitudes of children and young people of all ages, regardless of their level of understanding and critical reasoning abilities. These findings may be useful to inform the thinking of policy makers, particularly in terms of restrictions based on age and changing patterns of media consumption.

References

1. Lapierre MA, Fleming-Milici F, Rozendaal E, McAlister AR, Castonguay J. The Effect of Advertising on Children and Adolescents. *Pediatrics*. 2017;140(Supplement 2):S152. doi:10.1542/peds.2016-1758V

2. Calvert SL. Children as Consumers: Advertising and Marketing. *The Future of Children*. 2008;18(1):205-234.

3. De Veirman M, Hudders L, Nelson MR. What Is Influencer Marketing and How Does It Target Children? A Review and Direction for Future Research. Review. *Frontiers in Psychology*. 2019-December-03 2019;10doi:10.3389/fpsyg.2019.02685

4. Watkins L, Gage R, Smith M, McKerchar C, Aitken R, Signal L. An objective assessment of children's exposure to brand marketing in New Zealand (Kids'Cam): a cross-sectional study. *The Lancet Planetary Health*. 2022/02/01/ 2022;6(2):e132-e138. doi:<https://doi.org/10.1016/S2542-5196(21)00290-4>

5. Vakratsas D, Ambler T. How Advertising Works: What Do We Really Know? *Journal of Marketing*. 1999/01/01 1999;63(1):26-43. doi:10.1177/002224299906300103

6. Lavidge RJ, Steiner GA. A Model for Predictive Measurements of Advertising Effectiveness. *Journal of Marketing*. 1961/10/01 1961;25(6):59-62. doi:10.1177/002224296102500611

7. Jernigan D, Noel J, Landon J, Thornton N, Lobstein T. Alcohol marketing and youth alcohol consumption: a systematic review of longitudinal studies published since 2008. *Addiction*. 2017/01/01 2017;112(S1):7-20. doi:10.1111/add.13591

8. Winpenny EM, Marteau TM, Nolte E. Exposure of Children and Adolescents to Alcohol Marketing on Social Media Websites. *Alcohol and Alcoholism*. 2014;49(2):154-159. doi:10.1093/alcalc/agt174

9. El-Awa FMS, El Naga RA, Labib S, Latif NA. Tobacco advertising, promotion and sponsorship in entertainment media: a phenomenon requiring stronger controls in the Eastern Mediterranean Region. *East Mediterr Health J*. 2018;24(1):72-76. doi:10.26719/2018.24.1.72

10. McCausland K, Maycock B, Leaver T, Jancey J. The Messages Presented in Electronic Cigarette–Related Social Media Promotions and Discussion: Scoping Review. *J Med Internet Res*. 2019;21(2):e11953. doi:10.2196/11953

11. Singh S, Windle SB, Filion KB, et al. E-cigarettes and youth: Patterns of use, potential harms, and recommendations. *Preventive Medicine*. 2020/04/01/ 2020;133:106009. doi:<https://doi.org/10.1016/j.ypmed.2020.106009>

12. Coleman PC, Hanson P, van Rens T, Oyebode O. A rapid review of the evidence for children’s TV and online advertisement restrictions to fight obesity. *Preventive Medicine Reports*. 2022;26:101717. doi:10.1016/j.pmedr.2022.101717

13. Boyland EJ, Whalen R. Food advertising to children and its effects on diet: review of recent prevalence and impact data. *Pediatric Diabetes*. 2015/08/01 2015;16(5):331-337. doi:10.1111/pedi.12278

14. Smith R, Kelly B, Yeatman H, Boyland E. Food Marketing Influences Children's Attitudes, Preferences and Consumption: A Systematic Critical Review. *Nutrients*. Apr 18 2019;11(4)doi:10.3390/nu11040875

15. Russell SJ, Croker H, Viner RM. The effect of screen advertising on children's dietary intake: A systematic review and meta-analysis. *Obesity reviews : an official journal of the International Association for the Study of Obesity*. Apr 2019;20(4):554-568. doi:10.1111/obr.12812

16. Boyland EJ, Nolan S, Kelly B, et al. Advertising as a cue to consume: a systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults. *The American Journal of Clinical Nutrition*. 2016;103(2):519-533. doi:10.3945/ajcn.115.120022

17. WHO. Evaluating implementation of the WHO set of recommendations on the marketing of foods and non-alcoholic beverages to children. Progress, challenges and guidance for next steps in the WHO European Region. <http://www.euro.who.int/__data/assets/pdf_file/0003/384015/food-marketing-kids-eng.pdf>

18. De Jans S, Van de Sompel D, Hudders L, Cauberghe V. Advertising targeting young children: an overview of 10 years of research (2006–2016). *International Journal of Advertising*. 2017:1-34. doi:10.1080/02650487.2017.1411056

19. WHO. Tackling NCDs- 'Best buys' and other recommended interventions for the prevention and control of noncommunicable diseases. Accessed December 2, 2019, <https://apps.who.int/iris/bitstream/handle/10665/259232/WHO-NMH-NVI-17.9-eng.pdf?sequence=1>

20. Zarouali B, de Pauw P, Ponnet K, et al. Considering Children’s Advertising Literacy From a Methodological Point of View: Past Practices and Future Recommendations. *Journal of Current Issues & Research in Advertising*. 2019/05/04 2019;40(2):196-213. doi:10.1080/10641734.2018.1503109

21. Friestad M, Wright P. The Persuasion Knowledge Model: How People Cope with Persuasion Attempts. *Journal of Consumer Research*. 1994;21(1):1-31. doi:10.1086/209380

22. Rozendaal E, Lapierre MA, van Reijmersdal EA, Buijzen M. Reconsidering Advertising Literacy as a Defense Against Advertising Effects. *Media Psychology*. 2011/11/30 2011;14(4):333-354. doi:10.1080/15213269.2011.620540

23. Hudders L, De Pauw P, Cauberghe V, Panic K, Zarouali B, Rozendaal E. Shedding New Light on How Advertising Literacy Can Affect Children's Processing of Embedded Advertising Formats: A Future Research Agenda. *Journal of Advertising*. 2017;46(2):333-349. doi:10.1080/00913367.2016.1269303

24. John DR. Consumer Socialization of Children: A Retrospective Look at Twenty-Five Years of Research. *Journal of Consumer Research*. 1999;26(3):183-213. doi:10.1086/209559

25. Harris JL, Brownell KD, Bargh JA. The Food Marketing Defense Model: Integrating Psychological Research to Protect Youth and Inform Public Policy. *Social Issues and Policy Review*. 2009/12/01 2009;3(1):211-271. doi:10.1111/j.1751-2409.2009.01015.x

26. Ali M, Blades M, Oates C, Blumberg F. Young children's ability to recognize advertisements in web page designs. *British Journal of Developmental Psychology*. 2009;27(1):71-83. doi:doi:10.1348/026151008X388378

27. WHO. Tackling food marketing to children in a digital world: trans-disciplinary perspectives. Children’s rights, evidence of impact, methodological challenges, regulatory options and policy implications for the WHO European Region. Accessed December 2, 2019, <http://www.euro.who.int/__data/assets/pdf_file/0017/322226/Tackling-food-marketing-children-digital-world-trans-disciplinary-perspectives-en.pdf>

28. Boyland E, Tatlow-Golden M. Exposure, Power and Impact of Food Marketing on Children: Evidence Supports Strong Restrictions. *European Journal of Risk Regulation*. 2017;8(2):224-236. doi:10.1017/err.2017.21

29. Steinberg L. Risk taking in adolescence: what changes, and why? *Annals of the New York Academy of Sciences*. 2004;1021:51-8. doi:10.1196/annals.1308.005

30. Knoll LJ, Magis-Weinberg L, Speekenbrink M, Blakemore SJ. Social influence on risk perception during adolescence. *Psychol Sci*. May 2015;26(5):583-92. doi:10.1177/0956797615569578

31. *EPPI-Reviewer 4.0: software for research synthesis.* London: Social Science Research Unit, Institute of Education, University of London.; 2010.

32. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine*. Jul 21 2009;6(7):e1000097. doi:10.1371/journal.pmed.1000097

33. Hempel S, Shetty KD, Shekelle PG, et al. Machine Learning Methods in Systematic Reviews: Identifying Quality Improvement Intervention Evaluations. Agency for Healthcare Research and Quality (US), Rockville (MD); 2012.

34. Higgins JPT, Green S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. Accessed November 15, 2020, <http://handbook.cochrane.org>.

35. Higgins JPT, Sterne JAC, Savović J, et al. A revised tool for assessing risk of bias in randomized trials In: Chandler J, McKenzie J, Boutron I, Welch V (editors). *Cochrane Database of Systematic Reviews*. 2016;(Issue 10 (Suppl 1))doi:dx.doi.org/10.1002/14651858.CD201601

36. Sterne JAC, Hernán MA, Reeves BC, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ*. 2016;355:i4919. doi:10.1136/bmj.i4919

37. *Stata Statistical Software: Release 16*. StataCorp LLC.; 2019.

38. Royne MB, Kowalczyk CM, Levy M, Fox AK. Milk, juice, or cola? Exploring the effect of product placement on children's attitudes and behavior. *Health Marketing Quarterly*. 2017 2017;34(2):128-141. doi:10.1080/07359683.2016.1275241

39. Higgins JPT, Green S. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. <http://handbook.cochrane.org>

40. Carter OB, Patterson LJ, Donovan RJ, Ewing MT, Roberts CM. Children's understanding of the selling versus persuasive intent of junk food advertising: implications for regulation. *Social Science & Medicine*. 2011 2011;72(6):962-8. doi:10.1016/j.socscimed.2011.01.018

41. Castonguay J. Portraying physical activity in food advertising targeting children. *Health Education*. 2015;115(6):No Pagination Specified. doi:10.1108/HE-07-2014-0080

42. Dias M, Agante L. Can advergames boost children's healthier eating habits? A comparison between healthy and non-healthy food. *Journal of Consumer Behaviour*. 2011;10(3):152-160. doi:10.1002/cb.359

43. Dixon H, Niven P, Scully M, Wakefield M. Food marketing with movie character toys: Effects on young children's preferences for unhealthy and healthier fast food meals. *Appetite*. 2017;117:342-350. doi:10.1016/j.appet.2017.07.014

44. Harris JL, Haraghey KS, Lodolce M, Semenza NL. Teaching children about good health? Halo effects in child-directed advertisements for unhealthy food. *Pediatric Obesity*. 2018 2018;13(4):256-264. doi:10.1111/ijpo.12257

45. Hudders L, Cauberghe V. The mediating role of advertising literacy and the moderating influence of parental mediation on how children of different ages react to brand placements. *Journal of Consumer Behaviour*. 2018;17(2):No Pagination Specified. doi:10.1002/cb.1704

46. Lapierre MA. Development and persuasion understanding: Predicting knowledge of persuasion/selling intent from children's theory of mind. *Journal of Communication*. 2015;65(3):423-442. doi:10.1111/jcom.12155

47. Owen L, Lewis C, Auty S, Buijzen M. Is children's understanding of nontraditional advertising comparable to their understanding of television advertising? *Journal of Public Policy & Marketing*. 2013;32(2):195-206. doi:10.1509/jppm.09.003

48. Rifon NJ, Quilliam ET, Paek HJ, Weatherspoon LJ, Kim SK, Smreker KC. Age-dependent effects of food advergame brand integration and interactivity. *International Journal of Advertising*. 2014 2014;33(3):475-508. doi:10.2501/IJA-33-3-475-508

49. Waiguny MKJ, Nelson MR, Terlutter R. The Relationship of Persuasion Knowledge, Identification of Commercial Intent and Persuasion Outcomes in Advergames-the Role of Media Context and Presence. *Journal of Consumer Policy*. 2014 2014;37(2):257-277. doi:10.1007/s10603-013-9227-z

50. An S, Kang H. Korean children's understanding of social media advergames: An exploratory study of ad recognition and skeptical attitudes toward advertising. *Journal of Consumer Behaviour*. 2019;18(5):387-398. doi:10.1002/cb.1778

51. Castonguay J. Sugar and Sports: Age Differences in Children’s Responses to a High Sugar Cereal Advertisement Portraying Physical Activities. *Communication Research*. 2019/07/01 2015;46(5):579-596. doi:10.1177/0093650215587357

52. Smith R, Kelly B, Yeatman H, et al. Advertising Placement in Digital Game Design Influences Children’s Choices of Advertised Snacks: A Randomized Trial. *Journal of the Academy of Nutrition and Dietetics*. 2020;120(3):404-413. doi:10.1016/j.jand.2019.07.017

53. Panic K, Cauberghe V, De Pelsmacker P. Comparing TV ads and advergames targeting children: The impact of persuasion knowledge on behavioral responses. *Journal of Advertising*. 2013 2013;42(2-3):264-273. doi:10.1080/00913367.2013.774605

54. Duke JC, Allen JA, Eggers ME, Nonnemaker J, Farrelly MC. Exploring Differences in Youth Perceptions of the Effectiveness of Electronic Cigarette Television Advertisements. *Nicotine & Tobacco Research*. 2016 2016;18(5):1382-1386. doi:10.1093/ntr/ntv264

55. Farrelly MC, Duke JC, Crankshaw EC, et al. A Randomized Trial of the Effect of E-cigarette TV Advertisements on Intentions to Use E-cigarettes. *American Journal of Preventive Medicine*. 2015 2015;49(5):686-693. doi:10.1016/j.amepre.2015.05.010

56. Kim M, Popova L, Halpern-Felsher B, Ling PM. Effects of e-Cigarette Advertisements on Adolescents' Perceptions of Cigarettes. *Health Communication*. 2017 2017:1-8. doi:10.1080/10410236.2017.1407230

57. Padon AA, Lochbuehler K, Maloney EK, Cappella JN. A Randomized Trial of the Effect of Youth Appealing E-Cigarette Advertising on Susceptibility to Use E-Cigarettes Among Youth. *Nicotine & Tobacco Research*. 2018 2018;20(8):954-961. doi:10.1093/ntr/ntx155

58. van Berlo ZMC, van Reijmersdal EA, Rozendaal E. The rules of the game. The role of brand familiarity in mobile advergames [Dutch]. *Tijdschrift Voor Communicatiewetenschap*. 2017;45(3):216-+.

59. van Berlo ZMC, van Reijmersdal EA, Rozendaal E. Adolescents and handheld advertising: The roles of brand familiarity and smartphone attachment in the processing of mobile advergames. <https://doi.org/10.1002/cb.1822>. *Journal of Consumer Behaviour*. 2020/09/01 2020;19(5):438-449. doi:<https://doi.org/10.1002/cb.1822>

60. Vogel EA, Ramo DE, Rubinstein ML, et al. Effects of Social Media on Adolescents’ Willingness and Intention to Use E-Cigarettes: An Experimental Investigation. *Nicotine & Tobacco Research*. 2021;23(4):694-701. doi:10.1093/ntr/ntaa003

61. Matthes J, Naderer B. Children's consumption behavior in response to food product placements in movies. *Journal of Consumer Behaviour*. 2015 2015;14(2):127-136. doi:10.1002/cb.1507

62. Naderer B, Matthes J, Mestas M. Do you take credit cards? The attitudinal and behavioral effects of advergames targeted at children. *Journal of Consumer Behaviour*. 2016;15(6):580-588. doi:10.1002/cb.1599

63. Neyens E, Smits T, Boyland E. Transferring game attitudes to the brand: Persuasion from age 6 to 14. *International Journal of Advertising: The Review of Marketing Communications*. 2017;36(5):724-742. doi:10.1080/02650487.2017.1349029

64. Petrescu DC, Vasiljevic M, Pepper JK, Ribisl KM, Marteau TM. What is the impact of e-cigarette adverts on children's perceptions of tobacco smoking? An experimental study. *Tobacco Control*. 2017 2017;26(4):421-427. doi:10.1136/tobaccocontrol-2016-052940

65. Sharma RW. Communicating across age-groups: Variance in consumer attitudes from tweenagers to adults. *Young Consumers*. 2015 2015;16(3):348-362. doi:10.1108/Yc-04-2014-00437

66. Tarabashkina L, Quester P, Crouch R. Food advertising, children's food choices and obesity: interplay of cognitive defences and product evaluation: an experimental study. *International Journal of Obesity*. 2016 2016;40(4):581-6. doi:10.1038/ijo.2015.234

67. Tarabashkina L, Quester P, Tarabashkina O. Perceived informative intention in advertising and its attenuating effect on persuasion attribution among children. *Psychology and Marketing*. 2018 2018;35(10):778-789. doi:10.1002/mar.21134

68. Tarabashkina L, Quester P, Tarabashkina O, Proksch M. When persuasive intent and product’s healthiness make a difference for young consumers. *Young Consumers*. 2018 2018;19(1):38-54. doi:10.1108/YC-08-2017-00729

69. Te'eni-Harari T. Clarifying the Relationship between Involvement Variables and Advertising Effectiveness among Young People. *Journal of Consumer Policy*. 2014 2014;37(2):183-203. doi:10.1007/s10603-013-9226-0

70. Uribe R, Fuentes-Garcia A. The effects of TV unhealthy food brand placement on children. Its separate and joint effect with advertising. *Appetite*. 2015 2015;91:165-72. doi:10.1016/j.appet.2015.03.030

71. van Reijmersdal EA, Jansz J, Peters O, van Noort G. The effects of interactive brand placements in online games on children's cognitive, affective, and conative brand responses. *Computers in Human Behavior*. 2010 2010;26(6):1787-1794.

72. Vasiljevic M, St John W, Codling S, Couturier DL, Sutton S, Marteau TM. E-cigarette adverts and children's perceptions of tobacco smoking harms: an experimental study and meta-analysis. *BMJ Open*. 2018 2018;8(7):e020247. doi:10.1136/bmjopen-2017-020247

73. Verhellen Y, Oates C, De P, Dens N. Children's Responses to Traditional Versus Hybrid Advertising Formats: The Moderating Role of Persuasion Knowledge. *Journal of Consumer Policy*. 2014 2014;37(2):235-255. doi:10.1007/s10603-014-9257-1

74. Naderer B, Matthes J, Zeller P. Placing snacks in children's movies: cognitive, evaluative, and conative effects of product placements with character product interaction. *International Journal of Advertising*. 2018;37(6):852-870. doi:10.1080/02650487.2017.1348034

75. Uribe R, Fuentes-García A. Disclosing Product Placements of Fast Food to Children: The Importance of Reinforcing the Use of Disclosures and the Age of Children. *Health Communication*. 2020;35(11):1415-1425. doi:10.1080/10410236.2019.1636344

76. van Reijmersdal EA, van Dam S. How Age and Disclosures of Sponsored Influencer Videos Affect Adolescents’ Knowledge of Persuasion and Persuasion. *Journal of Youth and Adolescence*. 2020;49(7):1531-1544. doi:10.1007/s10964-019-01191-z

77. Coates AE, Hardman CA, Halford JCG, Christiansen P, Boyland EJ. The effect of influencer marketing of food and a “protective” advertising disclosure on children's food intake. *Pediatric Obesity*. 2019;14(10):e12540. doi:<https://doi.org/10.1111/ijpo.12540>

78. van Reijmersdal EA, Boerman SC, Buijzen M, Rozendaal E. This is Advertising! Effects of Disclosing Television Brand Placement on Adolescents. *Journal of Youth & Adolescence*. 2017 2017;46(2):328-342. doi:10.1007/s10964-016-0493-3

79. Caraher M, Landon J, Dalmeny K. Television advertising and children: lessons from policy development. *Public Health Nutr*. Aug 2006;9(5):596-605. doi:10.1079/phn2005879

80. O'Sullivan T. Get MediaSmart®: A Critical Discourse Analysis of Controversy Around Advertising to Children in the UK. *Consumption Markets & Culture*. 2007;10(3):293-314. doi:10.1080/10253860701365397

81. Qutteina Y, De Backer C, Smits T. Media food marketing and eating outcomes among pre-adolescents and adolescents: A systematic review and meta-analysis. *Obesity Reviews*. 2019;20(12):1708-1719. doi:10.1111/obr.12929

82. WHO. Food marketing exposure and power and their associations with food-related attitudes, beliefs and behaviours: a narrative review. Accessed 21 February 2022, <https://www.who.int/publications/i/item/9789240041783>

83. Norman J, Kelly B, McMahon AT, Boyland E, Chapman K, King L. Remember Me? Exposure to Unfamiliar Food Brands in Television Advertising and Online Advergames Drives Children's Brand Recognition, Attitudes, and Desire to Eat Foods: A Secondary Analysis from a Crossover Experimental-Control Study with Randomization at the Group Level. *J Acad Nutr Diet*. Jan 2020;120(1):120-129. doi:10.1016/j.jand.2019.05.006

84. Harris JL, Kalnova SS. Food and beverage TV advertising to young children: Measuring exposure and potential impact. *Appetite*. Apr 1 2018;123:49-55. doi:10.1016/j.appet.2017.11.110

85. Critchlow N, Newberry Le Vay J, MacKintosh AM, Hooper L, Thomas C, Vohra J. Adolescents’ Reactions to Adverts for Fast-Food and Confectionery Brands That are High in Fat, Salt, and/or Sugar (HFSS), and Possible Implications for Future Research and Regulation: Findings from a Cross-Sectional Survey of 11–19 Year Olds in the United Kingdom. *International Journal of Environmental Research and Public Health*. 2020;17(5)doi:10.3390/ijerph17051689

86. Ofcom. *Children and parents: media use and attitudes report 2022*. 2022. <https://www.ofcom.org.uk/__data/assets/pdf_file/0024/234609/childrens-media-use-and-attitudes-report-2022.pdf>

87. Harris JL, Yokum S, Fleming-Milici F. Hooked on Junk: Emerging Evidence on How Food Marketing Affects Adolescents’ Diets and Long-Term Health. *Current Addiction Reports*. 2021;8(1):19-27. doi:10.1007/s40429-020-00346-4

88. Taillie LS, Busey E, Stoltze FM, Dillman Carpentier FR. Governmental policies to reduce unhealthy food marketing to children. *Nutrition Reviews*. 2019;77(11):787-816. doi:10.1093/nutrit/nuz021

**Figure 1.** PRISMA screening flowchart

**Figure 2.** Forest plot showing SMD in brand and product attitudes between any advertising exposure and no advert or neutral advert controls; 95% CIs and study weights are indicated. Overall SMD was generated by a random effects model.

Footnote: (1) Data from cola product placement vs control with cola attitude question; (2) Data from juice product placement vs control with juice attitude question; (3) Data from milk product placement vs control with milk attitude question

**Figure 3.** Forest plot showing SMD in brand or product attitudes between digital and non-digital advertising exposure and no advert or neutral advert controls; 95% CIs and study weights are indicated. Overall SMD was generated by a random effects model

Footnotes: Matthes (1) Brand attitude outcome; Matthes (2) Product attitude outcome; Royne (1) Data from cola product placement vs control with cola attitude question; Royne (2) Data from juice product placement vs control with juice attitude question; Royne (3) Data from milk product placement vs control with milk attitude question