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Regulating children's exposure to food marketing on television: are the restrictions during children's programmes enough?

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Abstract: Due to rising global rates of childhood obesity, the World Health Organization (WHO) has recommended the adoption of policies to restrict children's exposure to the advertising of unhealthy foods and beverages. In 2017, the Slovenian government introduced regulations to restrict the advertisement of unhealthy foods and beverages during designated children's television programming. The objective of our study was to assess the impact of these regulations on children's exposure to food advertising, including during children's programmes and at peak viewing times for children. Using a standardised methodology, we investigated a large sample of 6479 food advertisements broadcast during 1652 h of television programming between 2016 and 2018 on the five most popular television channels for children aged 4–9 years. Advertised food products were coded using the WHO Regional Office for Europe Nutrient Profile Model, modified for Slovenia. The average overall frequency of not permitted (unhealthy) food advertising (±SD; standard deviation) per hour was 2.90 ± 3.22 (2016), 2.66 ± 3.55 (2017), or 2.13 ± 3.04 (2018) ads/h/channel. The frequency of not permitted food ads decreased to 0.02 ± 0.01 per h/channel during cartoons and other children's programmes in 2018. The new Slovenian food marketing regulations have reduced the advertising of unhealthy foods during children's programmes. However, children's viewership rates are also high outside of this designated programming and, as such, children's overall exposure to unhealthy food advertising is unlikely to have been reduced considerably by the regulations. Future policy interventions should be planned to cover not only children's programmes but also broadcasting periods that include the greatest numbers of child viewers. The implementation of such policies would be more challenging given that children's peak viewing times often intersect with prime time.

Keywords: marketing, advertising, children, advertising restrictions, food marketing, television advertising

Introduction

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Childhood obesity has been increasing in recent decades, making it a serious global public health problem. Globally, nearly one in five children or adolescents is overweight or obese; without intervention, these young people are likely to continue to carry excess weight into adulthood (1). Currently, approximately 13% of the world's population is obese and thus more susceptible to noncommunicable diseases (NCDs) and premature death than those with a normal body weight (2).

Children's exposure to food marketing is recognised as one of the important contributors to unhealthy weight gain in childhood. There is convincing evidence that exposure to this marketing affects children's food preferences, nutrition knowledge and consumption patterns (3, 4). This is especially concerning given that the marketed foods are typically those with an unfavourable nutritional composition: high in added salt, sugar and fats (5). Therefore, restricting children's exposure to food marketing is an important global priority for obesity and NCD prevention (6-8). The adoption of policies to reduce the impact of the marketing of unhealthy foods and beverages to children was identified in the World Health Organization (WHO) Global Action Plan for the prevention and control of NCDs 2013–2020 (8). Monitoring is needed to ensure adequate policy implementation, as well as for evaluating the impact of the implemented policies and suggesting any necessary modifications. To support the harmonised monitoring of food marketing across different countries, a standardised protocol was developed by INFORMAS (9), the International Network for Food and Obesity: Non-communicable Diseases (NCDs) Research, Monitoring and Action Support (10). Tools for monitoring food and beverage marketing to children are also provided by the WHO Regional Office for Europe (11).

Despite the high-level calls from international health organisations to limit children's exposure to unhealthy food marketing, progress in implementing effective policies has been relatively slow and mostly limited to industry-led initiatives, which have often been shown to be less effective than statutory approaches (12-15). In Europe, approximately half of the countries from the region report taking legal steps towards limiting the advertising of foods high in saturated fats, trans fats, free sugars and/or salt (HFSS) to children (16). As voluntary self-regulation programmes are insufficient for limiting children's exposure to the marketing of unhealthy foods, the WHO recommended that governments adopt comprehensive legal restrictions that would protect children from the harmful effects of such advertising and work in the best interests of children (17). In Europe, the WHO Regional Office for Europe proposed a nutrient profile model that works as a template for governments to define which

foods and beverages would be permitted for advertising to children (18). This model can be adapted to best suit each country's needs.

Governments need to define the specific platforms to which marketing restrictions would apply. Besides television broadcasting, children can also be influenced through other media platforms, such as web pages, social media and smartphone applications. In Europe, the current restrictions on food advertising to children mostly apply to broadcasted television advertising, while other platforms are not yet covered to such an extent (17). There are substantial differences between countries regarding the age limit and broadcast periods to which the regulations apply. For example, in the United Kingdom (19), Ireland (20) and Portugal (21), the restrictions apply not only to children's channels and children's programmes but also to the proportion of children in the viewing audience of particular television programmes. In some other countries, such as Turkey (22), Latvia (23) and Lithuania (24), food marketing restrictions apply only to children's programmes. In Slovenia, guidelines for creating rules on which foods can be advertised during children's programmes (25) were implemented in January 2017. These guidelines were a part of legislation protecting children from potentially harmful content (26), which includes exposure to unhealthy food advertising. However, the legislation states that each broadcast provider should create its own rules for restricting the advertising of unhealthy foods to children, considering the existing guidelines on this topic, but does not ban such advertising directly.

The objective of our study was to evaluate the impact of the new Slovenian regulations on restricting television advertising of unhealthy foods to children during children's programmes. To provide further insights about the possible migration of food advertising into unregulated broadcast periods, both children's and nonchildren's programmes were analysed. For comparison, peak vs. nonpeak children's viewing times were also investigated. Considering that regulatory intervention in Slovenia was introduced in January 2017, the study was conducted using pre- and post-regulation advertising data (2016–2018).

Methods

Collection of material

Data collection and analysis were performed according to the standardised INFORMAS protocol (10) and WHO recommendations. Sampling was done in Slovenia on five TV channels with the highest viewing rates of children (4–9 years old) in 2016–18. Viewing rates for each TV channel included and programme lists were provided by AGB Nielsen, an agency that captures television viewing in 450 households, with about 1300 individual viewers in

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Slovenia. Households included in the panel represent a cross section of representative homes across the country. Measurements are performed using a people meter system that provides information about who is watching which television channel at what time. In line with the protocol (10), yearly observation periods were from March until the end of May, excluding school and national holidays. Data for the year 2017 were therefore collected right after the restrictions were introduced. For each yearly observation period, nine days (five weekdays (WD) and four weekend days (WE)), were randomly selected, with a daily observation time from 6:00 to 22:00. If a specific television channel did not broadcast during the whole observation time, sampling was done for its time of broadcast. Altogether, 1652 h of programming were analysed. For each year, the sample included two national TV channels (SLO1 and SLO2), one commercial TV channel (POP TV) and two children TV channels (OTO and Minimax in 2016 and 2017; OTO and Nickelodeon in 2018). All broadcasted advertisements were identified, while recordings of these advertisements were saved for detailed content analysis. Considering the focus of this study, broadcasting time periods were categorised using two different assessment types:

- Based on the type of programme and target audience, all broadcasting was coded either as "children's programme" or "other programme". Typical children's programmes were cartoons, children's shows and similar content produced specifically for a child audience. Our sample included 741 h of children's programmes (248, 235 and 258 h in 2016, 2017 and 2018, respectively; Table 1). Children's programmes were identified based on the broadcast provider's classification of TV programmes. All children's programmes were subject to the 2017 policy intervention.
- Based on viewing rates, all broadcasting was also coded as either "peak child viewing times" or "other viewing times". For the purpose of this study, the peak child viewing times were considered the five hours of broadcast programming with the highest viewing rates among children aged 4–9, assessed separately for weekdays and weekends (Table S1). Our sample included 501 h of peak child viewing times (163–175 h per year; Table 1). It should be noted that "peak child viewing times" were only partially affected by the regulatory intervention (only when children's programmes were broadcasted during peak child viewing times).

Table 1. Television sample description by assessment type.

Assessment type	**Time slot**	**Hours recorded per year**	**Total hours recorded**

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By type of programme	Children's programmes (CP)	2016: 248 2017: 235 2018: 258	741
	Other programmes (OP)	2016: 298 2017: 311 2018: 302	911
By viewing rates (Children: 4–9 years old)	Peak child viewing times (CT)	2016:163 2017:163 2018:175	501
	Other viewing times (OT)	2016: 383 2017: 383 2018: 385	1151

Content analysis

Television advertisement was considered to be any paid commercial message broadcasted during a programme within the observation period. The term "food advertisement" referred to advertisements for any food or drink products as well as for food retailers (supermarkets and restaurants) and food companies, even though there was no specific product depicted. The term does not cover other types of marketing (i.e., product placement in shows, sponsorship of television shows, etc.). For each food advertisement, a variety of variables were coded according to the INFORMAS protocol (10), including the date, channel and time of broadcast; the programme category; the advertisement type; information on the product depicted, such as the company and brand name of the product; influence elements in the advertising strategy (cartoon/company-owned character; licenced character; amateur sportsperson; celebrity; movie tie-in; famous sportsperson/team; non-sports/historical events/festivals; 'for kids'; awards; and sports event); premium offers (game and app downloads; contests; 2-for-3 or another similar deal; 20% extra or another similar offer; limited edition; social charity; gift or collectable; price discount; and loyalty programs), benefit claims (sensory-based characteristics; new brand development; suggested use; suggested users are children or the whole family; emotive claims; puffery (claiming to be advantageous over other products); convenience; and price); and the presence of claims (health-related ingredients claims; nutritional content claims (e.g., low fat); comparative nutritional claims (e.g., reduced fat); general health claims (e.g., healthy diet); nutritional and other function claims (e.g., calcium is good for bones); reduction of disease risk claims; and other claims (e.g., organic)).

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For further analysis, the advertised food products, brands or retailers were identified and the foods included in the advertisements were profiled using a Slovenian modification of the WHO Regional Office for Europe Nutrient Profile model (WHO NP) (18)(25). Slovenian modification was made on the basis of specific lifestyle and dietary habits in Slovenia, and with consideration of dietary guidelines for children (27). The WHO Regional Office for Europe developed this model as a tool to help EU member states introduce regulations on marketing foods to children. Countries should modify it to meet their specific food supply and cultural eating patterns. In Slovenia, the WHO NP model was adopted with the following modifications:

- The food category "Beverages" has a new subcategory, "plant-based drinks," which includes various plant-based milk-like beverages like soy, rice, oat and almond milk. Total sugars in this subcategory are limited to 10 g/100 g, the salt content should not exceed 0.2 g, and they should not contain artificial sweeteners.
- Advertising of 100% fruit and vegetable juices/smoothies is permitted.
- In the category "Milk drinks," the upper limit for total fat is 3.5 g/100g and the total sugar limit is 10 g.
- For "Breakfast cereals," the minimum fibre content is 6 g/100 g and the maximum salt content is reduced to 1.2 g/100 g.
- "Yoghurt, sour milk, cream and other similar foods" is divided into two subcategories: "Yoghurt, sour milk and similar," for which the upper limit for total fat content is 3.2 g/100 g and 2.6 g for saturated fat; also, artificial sweeteners are not allowed; and "Cream and butter," which are not permitted in advertising.
- For "Fresh or dried pasta, rice and grains," the maximum salt content is reduced to 1 g/100 g.

All advertisements were first checked to determine if they included a product that was eligible for nutrient profiling. Advertisements for products such as food supplements, alcoholic beverages, baby food, coffee and tea; advertisements that do not promote specific food products; and those that advertise food retailers/restaurants were identified separately and coded as "foods not for profiling." The Nutrition Institute's database of branded foods in the Slovenian food supply (CLAS database) (28, 29) was used to provide data on the nutritional composition of foods, needed for the nutrient profiling of advertised foods. Where more than one food product was included in the food advertisement, the first product presented was

coded. Advertisements for products eligible for nutrient profiling were coded either as "permitted" or "not permitted" for advertising to children.

Advertisements for food companies or food store brands (as distinct from food product brands) were also included as food or beverage-related advertisements. To illustrate what types of food advertisements were broadcasted, the following categories were used in addition to those defined by the WHO NP model: supermarket advertisements (ads for supermarket chains, showing different food products, sold in specific supermarkets); food company brands (ads showing only the brand of a certain food producing company); food supplements; alcohol (alcoholic beverages); and other (coffee, seasoning blends). A full list of the categories is provided in Table S5.

Data analysis and statistical analyses

Data were collected in Microsoft® Excel 16.0 (Redmond, WA, USA) using spreadsheets, available as supporting tool of the INFORMAS protocol (10). The advertising frequency was determined by calculating the number of advertisements per hour, per channel for each year. This was further divided into the advertising frequency of permitted and not permitted foods in different time slots (CP, OP, CT, OT). For each sampling year, the most frequently advertised food categories were also determined. Data-weighting was used to overcome variations in advertising between weekdays and weekends and to derive estimates from combined weekday and weekend day data. We also investigated which persuasive marketing techniques were commonly used in different time slots.

Chi square testing was performed to analyse trends in the advertising of not permitted foods in different years for different time slots. Additionally, Chi square testing was used to test for differences in the distribution of different child persuasion strategies per type of program (time slot) and year. Two-way ANOVA was performed to analyse the influence of the assessment type and year on advertising frequency.

To ensure interrater reliability, two researchers each coded 1 h of television programming. Discrepancies were found in 2% of results, showing good agreement (30). Discrepancies were resolved to ensure further coding consistency.

Results

Altogether, we analysed 1652 h of broadcasted television (546 h in 2016, 546 h in 2017 and 560 h in 2018; Table 1) and 6479 food advertisements. As shown in Table 2, the number of food ads was similar in all three observation years (ranging from 2119 in 2017 to 2190 in

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2016). Around 23% of all television advertisements were for food and beverages. The observed average advertising frequency for food and beverages was not significantly different across years (3.91 ads/h/channel in 2016, 3.78 ads/h/channel in 2017 and 3.88 ads/h/channel in 2018, $p = 0.98$). Besides food and beverages that were considered as part of the WHO nutrient profiling, Table 2 also includes advertisements for coffee, tea, nutritional supplements, alcohol, food brands, baby foods and toddler formula and also for food companies, retailers and outlets that do not promote specific food products. Focusing on ads where nutrient profiling was possible, the frequency of ads for not permitted foods was notably higher than for permitted foods for all years, but the difference between the frequency of permitted and not permitted foods was not statistically significant ($p = 0.07$), nor was the interaction between years and nutrient profiling outcome significant ($p = 0.86$). The lowest ratio of ads for permitted versus not permitted foods was observed in 2018 (1:2), while notably higher ratios of not permitted foods were observed in 2016 and 2017 (1:3 and 1:5, respectively). Television data from 2018 had the lowest overall frequency of ads for not-permitted foods (2.13 ± 3.04 ads/h/channel), and the highest frequency of ads for permitted foods (1.16 ± 1.45 ads/h/channel).

Table 2. Average frequency of television food and beverage advertising in different years, applying the Slovenian modifications of the WHO Regional Office for Europe Nutrient Profile model.

			Average Frequency of Food Ads/h/Channel (SD)			
Year	% Ads for Food*	All Ads for Food (*N*)*	All Food*	Permitted**	Not-permitted***	Ratio Permitted: Not permitted
2016	24	2190	3.91 (4.37)	0.88 (1.05)	2.90 (3.22)	1:3
2017	23	2119	3.78 (4.60)	0.58 (0.80)	2.66 (3.55)	1:5
2018	23	2170	3.88 (4.82)	1.16 (1.45)	2.13 (3.04)	1:2

Notes: The ratio of permitted to not permitted was only calculated for products eligible for nutrient profiling according to the WHO Regional Office for Europe Nutrient Profile model. * "All food" includes advertisements for coffee, tea, alcohol, food brands, nutritional supplements, baby foods and toddler formula. In addition, it covers advertisements for food companies, retailers and outlets that do not promote specific food products. **"Permitted" means products that were eligible for nutrient profiling and scored as "permitted" for advertising according to the WHO Regional Office for Europe Nutrient Profile model. *** Not permitted means products that were eligible for nutrient profiling and

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scored as "not permitted" for advertising according to the WHO Regional Office for Europe Nutrient Profile model.

As presented in Table 3, advertising of not permitted foods during children's programmes dropped notably in 2017, after the implementation of the new regulations for restricting the advertising of unhealthy foods. However, the frequency of not permitted food ads during peak child viewing times was unchanged across years (from 2.02 ± 1.54 in 2016 to 2.26 ± 3.03 ads/channel/h in 2018; $p > 0.05$; Table 3). While during children's programmes we observed a trend for a reduction in the proportion of not permitted ads (from 11% in 2016 to 3% in 2018), this was not the case during peak child viewing times. During peak child viewing times the proportion of not permitted food ads increased from 21% in 2016 to 34% in 2018 ($p = 0.003$; Figure 1). The average frequencies of food ads in peak child viewing times show a similar trend, with the highest frequency of not permitted foods in 2018 (2.26 ± 3.03 ads/channel/h, in comparison with 2.02 ± 1.54 in 2016), while the opposite trend was observed in other viewing times (Table 3). To understand this, we looked at specific television channels. We observed that the frequency of overall advertising of foods was very low on all children's channels (an average of 0.8 ads/h in 2016 and 0.2 ads/h in 2018), while a higher penetration of food ads was observed on national television channels (up to 5.0 ads/h in both 2016 and 2018) and on commercial television channels (11.1 and 11.8 ads/h in 2016 and 2018, respectively). Interestingly, the frequency of advertisements for not permitted foods during peak child viewing times was lowest in 2018 for all channels, except for commercial television channels (4.4 ads/h in 2016 and 7.5 ads/h in 2018). On the other hand, the frequency of ads for permitted foods on the commercial channel also increased from 0.9 ads/h in 2016 to 3.8 ads/h in 2018. A significant difference between both types of assessment ($p = 0.003$) was observed in three-year trends for the percentage of advertising of not permitted foods (Figure 1).

Table 3. Average frequency of forbidden food and beverage advertisements in children's and other programmes and peak child and other viewing times.

	Not permitted food ads/channel/h (SD)			
	Assessment by type of programme		Assessment by viewing rates	
Year	Children's programmes	Other programmes	Peak child viewing times	Other viewing times
2016	0.16 (0.17)	4.64 (3.94)	2.02 (1.54)	3.30 (4.02)
2017	0.07 (0.07)	4.54 (4.64)	2.26 (2.80)	2.85 (3.90)
2018	0.02 (0.01)	3.83 (3.90)	2.26 (3.03)	2.08 (3.05)

Note: children's channels were excluded because these only aired children's programmes.

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Furthermore, the type of food advertisements was analysed according to the WHO NP food categories, modified for Slovenia with the additional categories "Supermarket advertisements," "Food Brands," "Food supplements," "Alcohol" and "Other". As Figure 2 shows, "Chocolate and candy" was the most advertised food category in all three years (representing 25%, 32%, and 20% of all food advertisements in 2018, 2017, and 2016, respectively). Other frequently advertised food categories in 2018 were "Supermarket advertisements" (13%), "Food supplements" (11%) and "Other beverages" (8%).

Figure 1. Proportion of ads for not permitted foods among all foods eligible for profiling in different years ($p = 0.003$).

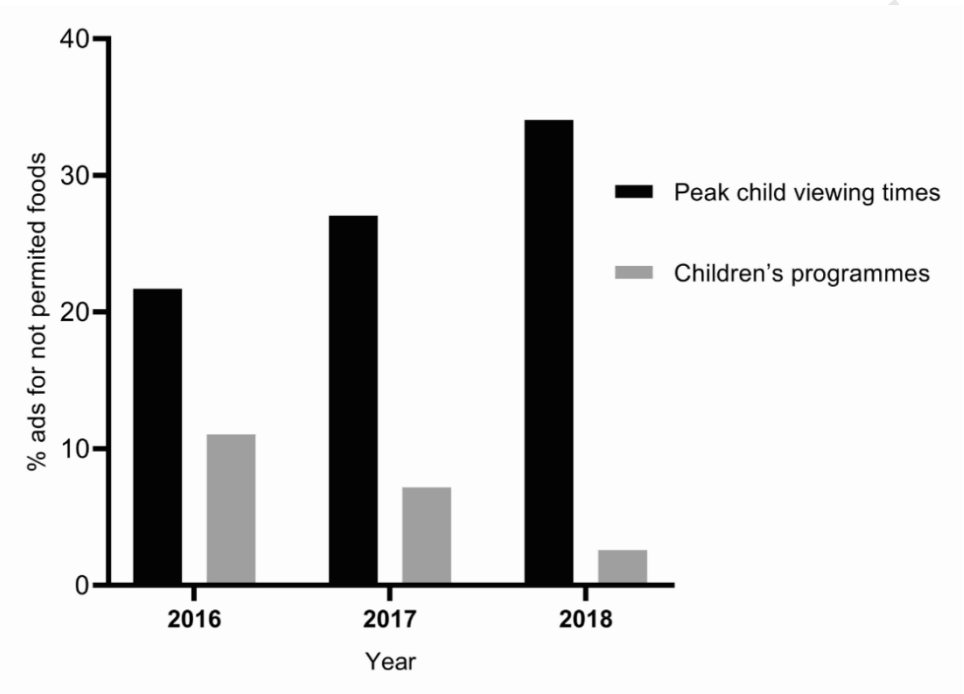
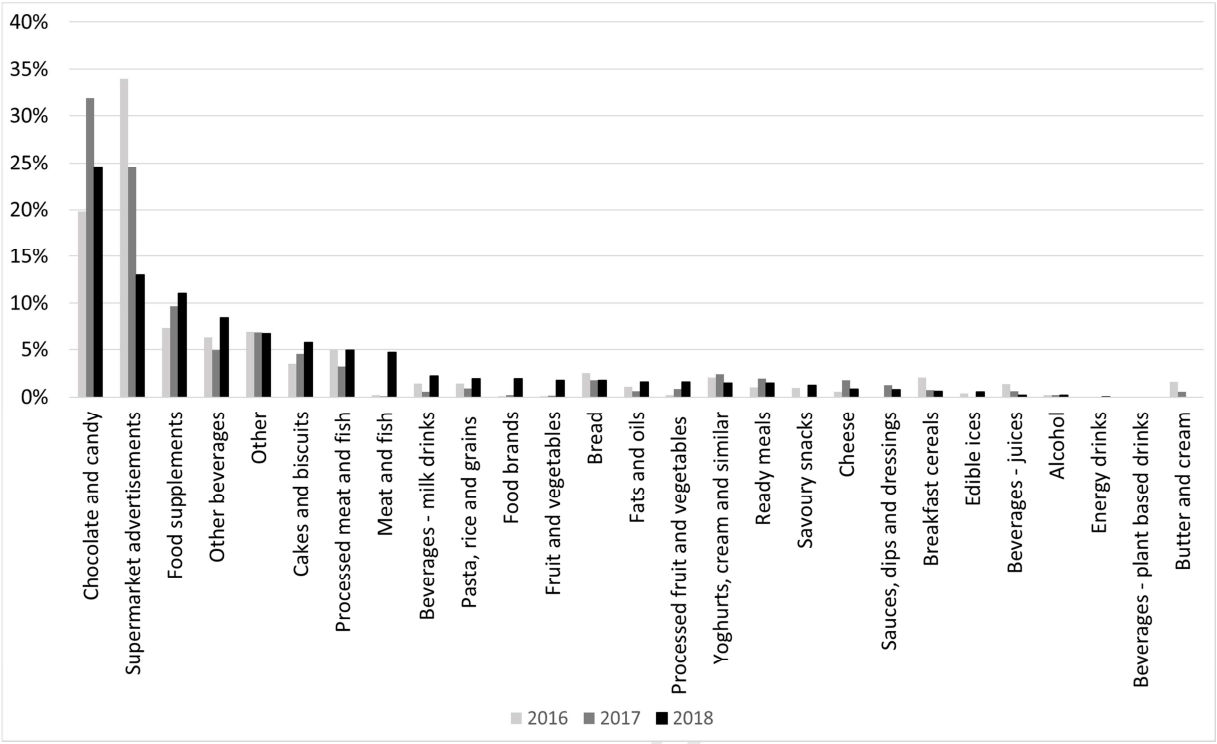


Figure 2. Proportion of ads in food categories in different years.



Note: "Other" mostly includes products such as coffee, tea and condiments, which do not fall into any of the other categories.

Finally, we examined the use of different advertising strategies, such as influence elements, premium offers and the presence of various claims, including nutritional and health claims. Analysis was performed on advertisements eligible for nutrient profiling. About 35% of all advertisements in 2018 were linked to some influence elements' advertising strategy (38% in 2016 and 51% in 2017; Tables 4 and S2). The most common advertising strategies were advertising messages referring to the statement that specific food is suitable for children ("For kids"), e.g., an image of a child. These were found on 13% of advertisements in 2018 (21% and 33% in 2016 and 2017, respectively), followed by cartoons or company-owned characters (e.g., M&M's) (16% in 2016 and 8% in 2018). When analysing advertisements aired during children's programmes, we found that the occurrence of such messages was much higher (64% in 2018, 90% in 2017 and 85% in 2016) than in other programmes.

Table 4. Proportion of ads with advertising strategy including various influence elements.

Year	2016	2017	2018	2018			
Strategy*	**All ads (%)**	**All ads (%)**	**All ads (%)**	**Ads during children's programmes (%)**	**Ads during nonchildren's programmes (%)**	**Permitted food ads (%)**	**Not permitted food ads (%)**
Cartoon/Company char.	16	11	8	64	7	0	12
Licenced character	1	1	0	0	0	0	0
Amateur sportsperson	0	0	3	0	3	1	3
Celebrity (nonsports)	4	7	3	0	3	5	2
Movie tie-in	2	7	0	0	0	0	0
Famous sportsperson/team	1	2	4	0	4	3	5
Nonsports/historical events	0	2	1	0	2	2	1
"For kids"	21	33	13	64	12	0	20
Awards	3	7	8	8	8	13	5
Sporting event	0	0	0	0	0	0	0

Note: *Data for advertisements eligible for nutrient profiling (N = 5776).

An analysis of advertising strategies linked to various premium offers is presented in Table S3. About a quarter of advertisements were linked to some premium offer. This trend increased from 2016 to 2018 (17% and 24%, respectively). In 2018, price discounts (19%), following by loyalty programmes (12%), were most common. Interestingly, in all the observed years, price discounts and loyalty programme premiums were more frequently found on advertisements for healthier (permitted) foods. However, such offers were rarely present during children's programmes. Exceptions are gift/collectable premiums in 2017, which may be due to a large marketing campaign for a dessert product, which was launched during our observation time by an international dairy producer.

Nutritional, health and other claims were found on 11%–19% of advertisements, with the highest proportions in 2018 (19%; Table S4). Among these, comparative nutritional (e.g., reduced fat) and other claims (e.g., organic) were most frequent (8% and 9%, respectively; 2018 data). On the other hand, the proportion of various types of health claims was below 1%. Among advertisements during children's programmes in 2018, only comparative nutritional claims were observed, and this was more common on less healthy foods. In 2018, only 4% of all ads for permitted foods included comparative nutritional claims, while in the advertising of forbidden foods the use of such claims was notably higher (10%).

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Discussion

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This study provides insights into how the regulation of food advertising during children's programmes (introduced in Slovenia in 2017) has affected children's exposure to television advertising of foods. Overall, there was a decrease in the overall frequency of advertising of not permitted foods between 2016 and 2018, but the differences were not statistically significant. This was due to considerable variability between the observed television channels. Commercial TV channels showed more advertising of not permitted foods than national channels. The lowest frequency of ads for not permitted foods during children's programmes was observed after the regulatory intervention, indicating a positive impact on minimising the advertising of unhealthy foods during this type of broadcast. While this is encouraging, reported data show that "peak child viewing time" is only partially considered as "children's programmes" (viewing rates provided by AGB Nielsen), so a considerable proportion of television programmes with high children's viewing rates is not regulated. As such, the impact on children's overall exposure to unhealthy food advertising is limited. Advertisements for foods that are not permitted to be advertised to children increased during peak child viewing times after the marketing regulations were introduced. We observed that children were typically in front of the television in the morning and in the evening. In Slovenia, evening cartoons are commonly aired before the 7 p.m. television news, so peak child viewing time extends into the after-news prime-time slot, which was mostly unaffected by the regulatory intervention. Our results showed that the regulatory intervention did not affect advertising in peak child viewing times because the restrictions only apply to children's programmes and not also to peak child viewing times. Although after the regulation children were less exposed to unhealthy food advertising during children's programmes, they remained exposed to advertising of unhealthy foods during prime time, which often intersects with their peak viewing times. Furthermore, while the frequency of overall advertising of foods was very low on all children's channels, higher penetration of food ads was observed especially on commercial television channels, which are watched by both children and adults. In this way, children are still exposed to food advertising but at different times, with an even higher proportion of advertisements for unhealthy foods. The most frequently advertised food category remains "Chocolate and candy," which was also what we observed in our 2013 study of television advertising (31).

Different types of regulations can have different impacts on children's exposure to food advertising (14), so the implemented food policies need to be monitored carefully to enable their improvement and the development of best practices that could be used in other

jurisdictions. We observed improvements in overall advertising and in advertising during regulated children's programmes, in that there were fewer advertisements for not permitted foods. On the other hand, the marketing of unhealthy foods during peak child viewing times of commercial television channels (peak child viewing times are not regulated) increased. These results point out a major limitation of the Slovenian regulatory intervention: it only applies to advertisements during and accompanying children's programmes. This was also confirmed in an additional analysis, where we extended the definition of children's programmes and included whole sets of advertisements before and after children's programmes. While in 2018 the frequency of ads for not permitted foods was almost negligible during children's programmes (0.11 ± 0.9 ads/h/channel), a notably higher frequency was observed during the extended children's time (1.07 ± 1.86). Some improvement was still observed when comparing the 2018 and 2016 data (1.89 ± 1.69), but to a lesser extent than for the nonextended children's time. This shows that a possible improvement of the regulation would be an extension of the regulated broadcasting time—for example, a definition of the exact interval before and after a children's programme to which the intervention is applicable. Such a policy has already been introduced in Portugal, where the regulation also covers the 30 min before and after a children's programme (21). If we want to efficiently protect children from the advertising of unhealthy foods, the regulated time periods should be reconsidered. Regulating peak child viewing times could be more effective, but such an approach brings some additional regulatory challenges. Our definition of peak child viewing times was related to audience metrics, which can only be gained for the past.

Another limitation of the Slovenian regulation is the limited enforcement tools. The regulation provided a WHO nutrient profiling model, modified for Slovenia, as a tool for broadcasters to identify unhealthy food advertising (26), but it does not specifically ban broadcasting of such advertisements, even during children's programmes. The regulations only state that, based on the provided nutrient profile model, each broadcast provider should prepare their own rules on food marketing to children. While the details of the restrictions are left to the broadcasters, it appears that their interpretation of the regulation has worked in reducing ads in children's programmes, but this will only have a limited impact on reducing the overall exposure to advertising of unhealthy foods as peak child viewing times also appear in other broadcasting periods. What was noted in practice is that some broadcasters committed to display messages about the importance of a healthy diet and exercise before the start of children's programmes in case of broadcasting advertisements for not permitted foods (32), but, considering the target population (children), the effects of such statements are questionable. Although the results of our study show that there was almost no advertising of not permitted foods during children's

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programmes, the periods before and after children's programmes are not well defined, thus presenting a risk of exposure.

Our observation that television advertising of unhealthy foods is particularly strong in peak child viewing times agrees with previous reports on this topic (31, 33-41). The problem persists, especially in evening prime time, when families including children are in front of the television. In these time periods, children's viewing rates are at their peak, yet the regulations do not apply. Such an issue has been identified in other jurisdictions. For example, in the United Kingdom in 2009, with the introduction of television food advertising restrictions, regulators identified that, although there were fewer advertisements for unhealthy foods during children's programmes, such advertising moved to prime-time hours, when both children and adults were watching. They suggested that restrictions targeting a wider range of advertisements and broadcast times were needed to efficiently protect children (42).

A recent study that included 22 countries concluded that the current regulatory restrictions in countries did not create an overall more favourable food advertising environment for children compared to countries without such restrictions (43). As seen from our results, food categories that include unhealthy foods still dominate in television food advertising. It is interesting that the advertising of food supplements has increased since 2016; the trend of growing advertising of these products was also noticed in our study on advertising in newspapers and magazines (44). Advertisements for unhealthy foods during peak child viewing times often include persuasive marketing elements, such as brand mascots, cartoon characters and similar (45). This is also what we found in our study, since the use of cartoon characters was much more common during children's programmes, especially in 2017 and 2018, after the implementation of the regulatory intervention in Slovenia. It has been shown that such elements are very appealing to children (46), making the advertised foods even more attractive to children. The use of such persuasive marketing techniques is prohibited in advertising on children's channels and programmes in some countries, such as Chile (47). In Ireland, they went even further: besides the prohibition on using licensed characters for children under 15, advertising of high fat, sugar and salt (HFSS) foods must not be promoted by celebrities and sportspersons or include nutritional and/or health claims (20).

In Europe, currently there are no umbrella regulations on food marketing to children, which makes it hard to avoid cross-border marketing. Restrictions would be more effective if European Union (EU) member states encouraged the European Commission to develop and implement effective policies on the EU level, rather than policies being country-specific. However, to maximize efficiency, policies should target not only broadcast media but also

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other forms of marketing. For example, digital marketing on social media platforms (48, 49) and marketing to children on food packages (50-53), which also poses a risk of children's exposure to marketing of unhealthy foods.

A major strength of the reported study is that we were in a position to use a very robust monitoring approach for the assessment of food advertising before and after the regulatory intervention. While many food-related policies are being introduced around the globe, it is not often that the impact of the regulation can be investigated in such detail. Our dataset was very large: we investigated almost 6500 food advertisements, aired in 1652 h of television programming. A common issue is that pre-intervention data is not available or different sampling approaches are used. INFORMAS (10) and WHO (11) guidelines were proved as useful tools to avoid this problem. On the other hand, a limitation of the study is that only five television channels per year were investigated, but these were selected on the basis of actual viewing rates for each year. Therefore, we assured that the television programmes that children watch the most were monitored. The sample included national channels as well as commercial and children's channels. Another limitation is that only nine days per year were monitored, but the same time of the year was monitored in all three observation years, and those nine sampling days considerably exceed the minimal sampling period of four days provided in the WHO recommendations (11). A final limitation is that we did not have access to the actual numbers of children watching specific programmes, which would have enabled us to calculate the exact exposure to advertisements. On the other hand, we had access to viewing rates, enabling us to identify peak child viewing times.

Conclusions and Policy implications

The study showed that restrictions on food marketing during children's television programmes had a positive effect in terms of minimising the exposure of children to the marketing of unhealthy foods. During nonchildren's programmes, this protection was limited—particularly in the prime time of one commercial television channel. To be more efficient, future regulatory interventions should carefully define the regulated periods—for example, extending it to the 30 min before and after the children's programme. Even more efficient protection of children would be provided by extending the regulated periods to peak child viewing times. Furthermore, we have shown that advertisers use cartoon characters and other strong marketing techniques to attract children apart from children's programmes, so the regulation of such marketing techniques would also be appropriate. It should be noted that other media platforms are gaining importance when considering children's exposure to the marketing of unhealthy foods. In most countries, including Slovenia, no restrictions for the

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marketing of unhealthy foods on websites, social media, mobile applications or sport events exist, which leaves an open space for marketers to reach vulnerable populations like children. Regulators should therefore adopt a comprehensive approach, targeting multiple media channels to ensure the best outcomes for children.

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References

Journal Pre-proof

1. WHO. Facts and figures on childhood obesity 2017 [Available from: http://www.who.int/end-childhood-obesity/facts/en/] (accessed on 20.4.2020).
2. WHO. Obesity and overweight 2018 [updated march 2013. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/] (accessed on 20.4.2020).
3. Cairns G. A critical review of evidence on the sociocultural impacts of food marketing and policy implications. Appetite. 2019;136:193-207.
4. Mau G, Schramm-Klein H, Schuhen M, Steinmann S. What helps children resist distracting marketing stimuli? Implementation intentions and restrictions alter food choice. Appetite. 2019;140:159-68.
5. Cairns G, Angus K, Hastings G, Caraher M. Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. Appetite. 2013;62(0):209-15.
6. WHO. Set of recommendations on the marketing of foods and non-alcoholic beverages to children 2010 [Available from: http://whqlibdoc.who.int/publications/2010/9789241500210_eng.pdf] (accessed on 20.4.2020)..
7. WHO. Interim Report of the Commission on Ending Childhood Obesity 2015 [13.4.2015]. Available from: http://www.who.int/end-childhood-obesity/commission-ending-childhood-obesity-interim-report.pdf?ua=1(accessed on 20.4.2020)..
8. WHO. Global action plan for the prevention and control of noncommunicable diseases 2013-2020 2013 [Available from: https://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1] (accessed on 20.4.2020).
9. Swinburn B, Sacks G, Vandevijvere S, Kumanyika S, Lobstein T, Neal B, et al. INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. Obesity Reviews. 2013;14:1-12.
10. INFORMAS. Protocols 2017 [Available from: https://www.informas.org/resources/] (accessed on 20.4.2020).
11. WHO. Monitoring food and beverage marketing to children via television and the Internet 2016 [Available from: http://www.euro.who.int/__data/assets/pdf_file/0011/333956/food-children-TV-internet-en.pdf?ua=1.
12. Boyland EJ, Harris JL. Regulation of food marketing to children: are statutory or industry self-governed systems effective? Public Health Nutr. 2017;20(5):761-4.
13. Dale Kunkel, Christopher McKinley MA, Paul Wright MA. The Impact of Industry Self-Regulation on the Nutritional Quality of Foods Advertised on Television to Children 2009 [Available from: https://pdfs.semanticscholar.org/6d50/c0d0e20f38cabbd36a4d12cf53473918d75a.pdf?_ga=2.26048 1229.1720815440.1568365190-665554722.1568016693] (accessed on 20.4.2020).
14. Galbraith-Emami S, Lobstein T. The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. Obesity Reviews. 2013;14(12):960-74.
15. Hawkes C, Harris JL. An analysis of the content of food industry pledges on marketing to children. Public Health Nutr. 2011;14(8):1403-14.
16. WHO. Better food and nutrition in Europe – Progress report 2018 [Available from: http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/publications/2018/better-food-and-nutrition-in-europe-progress-report-2018] (accessed on 20.4.2020).
17. WHO. Evaluating implementation of the who set of recommendations on the marketing of foods and non-alcoholic beverages to children 2018 [Available from: http://www.euro.who.int/__data/assets/pdf_file/0003/384015/food-marketing-kids-eng.pdf] (accessed on 20.4.2020).
18. WHO. WHO Regional Office for Europe nutrient profile model 2015 [25.3.2015]. Available from: http://www.euro.who.int/__data/assets/pdf_file/0005/270716/Nutrient-Profile-Model.pdf?ua=1] (accessed on 20.4.2020).

19. Ofcom. Television Advertising of Food and Drink Products to Children 2007 [Available from: https://www.ofcom.org.uk/__data/assets/pdf_file/0028/47746/Television-Advertising-of-Food-and-Drink-Products-to-Children-Final-statement-.pdf] (accessed on 20.4.2020).
20. Ireland BA. Children's Commercial Communications Code 2013 [Available from: http://www.bai.ie/en/codes-standards] (accessed on 20.4.2020).
21. Portugal. ANTEPROJETO DE TEXTO DE SUBSTITUIÇÃO RELATIVO AOS PROJETOS DE LEI No. 118/XIII (PAN), 120/XIII (PS) E 123/XII (PEV) "Introduz restrições à publicidade dirigida a menores de produtos com elevados teores de açúcar, gordura e sal, procedendo à 14ª alteração ao Código da Publicidade, aprovado pelo DecretoLei No. 330/90, de 23 de outubro" 2011 [Available from: http://app.parlamento.pt/webutils/docs/doc.pdf?path=6148523063446f764c324679626d56304c334e706447567a4c31684a53556c4d5a5763765130394e4c7a5a4452556c505543394562324e31625756756447397a5357357059326c6864476c3259554e7662576c7a633246764c3259774d5459334d7a49324c545578597a4d744e4459774f5331694e5463324c5745334d7a67774e6a6b305a446b334d5335775a47593d&fich=f0167326-51c3-4609-b576-a7380694d971.pdf&Inline=true] (accessed on 20.4.2020).
22. Radio and Television Supreme Council -Turkey. By-law on the Procedures and Principles of Media Services [Available from: https://www.rtuk.gov.tr/en/by-law-on-the-procedures-and-principles-of-media-services/5358/5175/by-law-on-the-proceduresand-principles-of-media-services.html] (accessed on 20.4.2020)..
23. Latvia. Law on the Handling of Energy Drinks 2016 [Available from: https://vvc.gov.lv/.../Law%20On%20the%20Handling%20of%20Energy%20Drinks.docx. (accessed on 20.4.2020).
24. Lithuania. Law on Advertising [Available from: https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/dd69e1e2a58711e59010bea026bdb259?jfwid=-ji9gtfc0m] (accessed on 20.4.2020).
25. Ministry of health - Republic of Slovenia. Nutritional guidelines for protection of children from inappropriate commercial communications (In Slovenian: Prehranske smernice za oblikovanje pravil ravnanja za zaščito otrok pred neprimernimi komercialnimi sporočili) Available online: https://www.gov.si/assets/ministrstva/MZ/DOKUMENTI/Preventiva-in-skrb-za-zdravje/Varovanje-in-krepitev-zdravja/prehrana-in-telesna-dejavnost/prehranske_smernice-oglasevanje_072016.pdf (accessed on 20.4.2020).
26. Republic of Slovenia. Audiovisual Media Services Act (In Slovenian: Zakon o avdiovizualnih medijskih storitvah). Available online: http://www.pisrs.si/Pis.web/pregledPredpisa?id=ZAKO6225 (accessed on 20.4.2020).
27. Gabrijelčič Blenkuš M, Gregorič M, Adamič M, Čampa A. Smernice zdravega prehranjevanja v vzgojno-izobraževalnih ustanovah. Ljubljana: Republika Slovenija Ministrstvo za zdravje; 2005.
28. NUTRIS. Podatkovna baza CLAS kot orodje za vrednotenje sprememb na področju ponudbe predpakiranih živil v Sloveniji. Available from: https://www.nutris.org/clas/ (accessed on 20.4.2020).
29. Pivk Kupirovič U, Miklavec K, Hribar M, Kušar A, Žmitek K, Pravst I. Nutrient Profiling Is Needed to Improve the Nutritional Quality of the Foods Labelled with Health-Related Claims. Nutrients. 2019;11(2):287.
30. Lombard M, Snyder-Duch J, Bracken CC. Content Analysis in Mass Communication: Assessment and Reporting of Intercoder Reliability. Human Communication Research. 2002;28(4):587-604.
31. Korošec Ž, Pravst I. Television food advertising to children in Slovenia: analyses using a large 12-month advertising dataset. Int J Public Health. 2016;61(9):1049-57.
32. Proplus. Pravila ravnanja v zvezi z neprimernimi avdiovizualnimi komercialnimi sporočili o živilih v programskih vsebinah, namenjenim otrokom 2017 [Available from: http://images.24ur.com/media/document/61881052.pdf] (accessed on 20.4.2020).
33. Kelly B, Chapman K, King L, Hebden L. Trends in food advertising to children on free-to-air television in Australia. Australian and New Zealand journal of public health. 2011;35(2):131-4.
34. Kelly B, Halford JC, Boyland EJ, Chapman K, Bautista-Castano I, Berg C, et al. Television food advertising to children: a global perspective. Am J Public Health. 2010;100(9):1730-6.
35. Kelly B, Hebden L, King L, Xiao Y, Yu Y, He G, et al. Children's exposure to food advertising on free-to-air television: an Asia-Pacific perspective. Health Promot Int. 2016;31(1):144-52.

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36. Kelly B, Smith B, King L, Flood V, Bauman A. Television food advertising to children: the extent and nature of exposure. Public Health Nutr. 2007;10(11):1234-40.
37. McHiza ZJ, Temple NJ, Steyn NP, Abrahams Z, Clayford M. Content analysis of television food advertisements aimed at adults and children in South Africa. Public Health Nutr. 2013;16(12):2213-20.
38. Powell LM, Schermbeck RM, Chaloupka FJ. Nutritional content of food and beverage products in television advertisements seen on children's programming. Childhood obesity (Print). 2013;9(6):524-31.
39. Jaichuen N, Vandevijvere S, Kelly B, Vongmongkol V, Phulkerd S, Tangcharoensathien V. Unhealthy food and non-alcoholic beverage advertising on children's, youth and family free-to-air and digital television programmes in Thailand. BMC public health. 2018;18(1):737-.
40. Watson WL, Lau V, Wellard L, Hughes C, Chapman K. Advertising to children initiatives have not reduced unhealthy food advertising on Australian television. J Public Health. 2017;39(4):787-92.
41. Smithers LG, Wang X, Haag D, Agnew B, Lynch J, Sorell M. Discretionary food advertising on television in 2017: a descriptive study. Australian and New Zealand journal of public health. 2019;43(6):519-21.
42. Adams J, Tyrrell R, Adamson AJ, White M. Effect of restrictions on television food advertising to children on exposure to advertisements for 'less healthy' foods: repeat cross-sectional study. PLoS One. 2012;7(2):e31578.
43. Kelly B, Vandevijvere S, Ng S, Adams J, Allemandi L, Bahena-Espina L, et al. Global benchmarking of children's exposure to television advertising of unhealthy foods and beverages across 22 countries. Obes Rev. 2019.
44. Lavriša Ž, Erjavec K, Pravst I. Trends in marketing foods to children in Slovenian magazines: a content analysis. Public Health Nutr. 2018:1-10.
45. Leon-Flandez K, Royo-Bordonada MA, Moya-Geromini MA, Bosqued-Estefania MJ, Lopez-Jurado L, Damian J. Marketing techniques in television advertisements of food and drinks directed at children in Spain, 2012. Int J Public Health. 2018;63(6):733-42.
46. Kraak VI, Story M. Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: a systematic review and research needs. Obesity Reviews. 2015;16(2):107-26.
47. Corvalan C, Reyes M, Garmendia ML, Uauy R. Structural responses to the obesity and non-communicable diseases epidemic: Update on the Chilean law of food labelling and advertising. Obes Rev. 2019;20(3):367-74.
48. Freeman B, Kelly B, Baur L, Chapman K, Chapman S, Gill T, et al. Digital junk: food and beverage marketing on Facebook. Am J Public Health. 2014;104(12):e56-64.
49. Vandevijvere S, Sagar K, Kelly B, Swinburn B. Unhealthy food marketing to New Zealand children and adolescents through the internet. N Z Med J. 2017;130(1450):32-43.
50. Lavriša Ž, Pravst I. Marketing of Foods to Children through Food Packaging Is Almost Exclusively Linked to Unhealthy Foods. Nutrients. 2019;11(5):1128.
51. Gimenez A, Saldamando L, Curutchet MR, Ares G. Package design and nutritional profile of foods targeted at children in supermarkets in Montevideo, Uruguay. Cad Saude Publica. 2017;33(5):e00032116.
52. Harris JL, Schwartz MB, Brownell KD. Marketing foods to children and adolescents: licensed characters and other promotions on packaged foods in the supermarket. Public Health Nutr. 2010;13(3):409-17.
53. Song H, Halvorsen B, Harley A. Marketing cereal to children: content analysis of messages on children's and adults' cereal packages. International Journal of Consumer Studies. 2014;38(6):571-7.

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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