

Exposure to unhealthy food and beverage advertising during the school commute in Australia

Gina Trapp,¹ Paula Hooper,² Lukar E Thornton,³ Kelly Kennington,⁴ Ainslie Sartori,⁴ Nicole Wickens ,¹ Wesley Billingham¹

¹Telethon Kids Institute, The University of Western Australia, Perth, Western Australia, Australia

²The University of Western Australia School of Design, Perth, Western Australia, Australia

³Centre for Physical Activity and Nutrition Research, Deakin University, Burwood, Victoria, Australia

⁴Cancer Council Western Australia, Subiaco, Western Australia, Australia

Correspondence to

Dr Gina Trapp, Telethon Kids Institute, Perth, WA 6009, Australia; gina.trapp@telethonkids.org.au

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ABSTRACT

Background Food marketing exposure has the potential to influence children's dietary behaviours and health status, however, few studies have identified how 'obesogenic' the outdoor food marketing environment is along public transport (bus and/or train) or walking routes that children take to school.

Methods Audits of all outdoor advertisements present along likely train, bus and walking routes to 24 secondary schools (ie, 3 routes per school, 72 routes total) were conducted in Perth, Western Australia (WA). The size, content, type and setting of each advertisement were recorded in accordance with the International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support protocol for monitoring outdoor advertising.

Results Of the 4016 total advertisements observed, almost half were for food (n=1754, 44%) and of these, 80% (n=1397) advertised discretionary (non-core) foods, and 8% (n=138) advertised healthy (core) foods. On average, commuting to school by train, bus and walking exposed Perth schoolchildren to 37.1, 22 and 4.5 discretionary (non-core) food ads per one-way trip to school, respectively.

Conclusions Children living in Perth, WA experience a high level of exposure to unhealthy outdoor food advertisements during the school commute. Policies which restrict the placement and content of outdoor advertising, could be a useful strategy in the fight against childhood obesity.

INTRODUCTION

In order to improve children's nutritional intake at the population level, comprehensive strategies to discourage consumption of 'discretionary foods' are needed, including environmental changes that reduce the cues for consumption of these foods.¹ Indeed, a critical component of the WHO's Global Action Plan for the Prevention and Control of Non-Communicable Diseases (NCDs)² is to reduce the marketing of unhealthy foods and beverages to children. Several reviews have found exposure to food marketing influences brand recognition, food preference, consumption patterns and health status in both younger and older children.³⁻⁷ This illustrates just how powerful food marketing can be, and that efforts to reduce the advertising of unhealthy foods and beverages to children may be enormously protective of their overall health and well-being.

Many studies have documented the predominance of advertisements for discretionary foods on children's television.⁸⁻¹⁰ However, a growing

body of literature suggests that outdoor advertising (ie, advertisements posted on billboards, walls, bus shelters, shop fronts, etc) also constitutes a frequent source of children's exposure to unhealthy food and beverage advertising.¹¹⁻¹⁷ According to the Outdoor Media Association, in Australia, outdoor advertising is a rapidly growing form of marketing, reaching 12.2 million people daily, with an average of 26 advertisements viewed daily per person.¹⁸ Previous Australian research has found a high overall number of food advertisements (of which, 70% were for discretionary foods) in the area surrounding primary schools in Sydney and Wollongong.¹¹ High levels of unhealthy food advertising have also been found on Australian public transportation networks. For example, Sainsbury *et al*¹⁵ found 84.3% of all food advertisements on and immediately surrounding all 178 train stations on the Sydney metropolitan train network were for discretionary foods and Parnell *et al* identified that one-third of all bus shelter advertisements within 500 m of Perth schools were for unhealthy products which included unhealthy foods.¹³ A clearer understanding of how 'obesogenic' the food marketing environment is along routes to schools is needed to inform policies and interventions aimed at improving young people's nutrition and overall health. Thus, the overall aim of this study was to investigate the quantity and type of outdoor advertisements located along the expected train, bus and walking routes to schools located in Perth, Western Australia (WA).

METHODS

A sample of 24 schools (representing 26 967 students; 23 427 of secondary school age)¹⁹ were randomly selected based on binary stratification by local government area, population density (high/low) and area-level socioeconomic status (high/low). For each of the 24 schools, one theoretical train route, one theoretical bus route and one theoretical walking route to the school entrance (all one-way trips) were selected using google maps and Transperth journey planner and methods previously described by Richmond *et al*.¹⁷ Train routes included identifying all outdoor advertisements located at two train stations, one nearest the school and another station one stop away. If the train station also included a bus station that schoolchildren would need to walk through to access the train station, all visible outdoor advertisements at the bus station (including on buses) were recorded. To simulate a child catching the bus to school from the train



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station closest to the school (approx. 6 km journey), all outdoor advertisements located at the bus station (if present) or at the bus stop and along the bus route from the closest train station to the school gate, were recorded. Outdoor advertisements visible from the train on the journey between the two train stations were not included. Bus routes included identifying all outdoor advertisements visible while waiting at a bus stop, travelling 2–3 km, alighting at the stop closest to the school and walking to the school gate. Walking routes included identifying all outdoor advertisements visible along a 500 m walk along a main road to the school gate. This distance (ie, 500 m) was chosen because it aligned with the International Network for Food and Obesity/NCDs Research, Monitoring and Action Support (INFORMAS) Protocol for outdoor advertising.²⁰ Researchers were provided with a customised tablet device and field training in how to identify, photograph, code and record the geolocation of each outdoor advertisement along each route. Inter-rater reliability was assessed (98%). Data collection occurred during the school term in December 2020.

Advertisements were coded using the INFORMAS Protocol for outdoor advertising.²⁰ This included the size (ie, small ≥ 4 but $< 1.3 \times 1.9$ m, medium $> 1.3 \times 1.9$ m but $< 2.0 \times 2.5$ m or large $> 2.0 \times 2.5$ m), type (ie, billboard, poster or banner, free-standing, painted building/wall, digital signs/light emitting diode (LED), merchandising) setting (attached to food shop, attached to non-food shop or business, roadside, on a building, bus shelter, train station, on a bus, petrol station or bottle shop) and

content (healthy (core) foods recommended to meet daily nutritional requirements, discretionary/unhealthy (non-core) foods which are surplus to daily requirements, ‘miscellaneous’, that is, tea, coffee, spices, supplements, or ‘branding’ that is, business logo, company or brand—no actual product).

Statistical analysis

Descriptive statistics were used to summarise the density (count), size and type of advertisements present along each route to school.

RESULTS

Of the 72 selected school routes (ie, 24 train routes, 24 bus routes, 24 walk routes; 1 train, 1 bus, 1 walk route per school), 4 school routes had no outdoor advertisements, one school had no advertisements along the train route and three schools had no advertisements along the 500 m walking route to the school. Some schools had routes that crossed over with another route, therefore shared the same advertisements and were included for both routes.

Table 1 shows the total number of advertisements identified (food and non-food), stratified by route type. In total, 4016 outdoor advertisements were identified along theoretical bus, train and walking routes for all of the 24 schools combined. Of these, 44% (n=1754) were classified as food advertisements and 56% (n=2262) non-food advertisements. Of the 1754 food

Table 1 Outdoor advertisements (ads) identified along one-way train, bus and walking routes to schools in Perth, Western Australia

	Train routes to school		Bus routes to school		Walk routes to school		All ads
	Total N ads per one-way trip (all schools combined)	Average N ads per one-way trip (per school)	Total N ads per one-way trip (all schools combined)	Average N ads per one-way trip (per school)	Total N ads per one-way trip (all schools combined)	Average N ads per one-way trip (per school)	
All outdoor ads	2506	104.4	1501	62.5	307	12.8	4016
Food ads	1070	44.6	714	29.8	134	5.6	1754
Discretionary (non-core)	890	37.1	528	22	108	4.5	1397
Healthy (core) foods	56	2.4	84	3.5	13	0.6	138
Miscellaneous foods	37	1.5	33	1.4	6	0.25	70
Branding only	87	3.6	69	2.9	7	0.3	149
Size of food ads							
Small	470	19.6	432	18	103	4.3	894
Medium	474	19.8	245	10.2	24	1	698
Large	126	5.3	37	1.5	7	0.3	162
Type of food ads							
Billboard	7	0.3	2	0.08	0	0	8
Poster or banner	857	35.7	463	19.3	76	3.2	1286
Free-standing	174	7.25	192	8	55	2.3	378
Painted building/wall	12	0.5	24	1	1	0.04	33
Digital sign/LED sign	5	0.2	7	0.3	0	0	11
Merchandising	15	0.63	26	1.08	2	0.08	38
Setting of food ads							
Food shop	492	20.5	492	20.5	105	4.4	968
Bottle shop	134	5.6	136	5.7	23	1	256
Petrol station	58	2.4	117	4.8	26	1.08	170
Non-food shop/business	18	0.75	18	0.75	10	0.4	32
Roadside	91	3.8	108	4.5	18	0.75	203
On a building	8	0.3	12	0.5	0	0	19
Bus shelter	21	0.9	78	3.25	1	0.04	92
Train station	84	3.5	6	0.25	0	0	84
Ad on a bus	356	14.8	0	0	0	0	356

LED, light emitting diode.

Table 2 Frequency of food products advertised on outdoor advertisements located along one-way train, bus and walking routes to Perth schools

Food category	All ads	Train route ads	Bus route ads	Walking route ads
	N (%)	N (%)	N (%)	N (%)
Discretionary (non-core) food category				
Sugar sweetened drinks (eg, soft drinks, energy drinks, electrolyte drinks)	425 (24)	308 (29)	121 (17)	22 (16)
Alcoholic beverages	344 (20)	171 (16)	189 (26)	35 (26)
Fast food meals (eg, burgers, chips, pizza, fish and chips, kebabs)	332 (19)	204 (19)	134 (18)	26 (19)
High fat/salt meals (eg, fried foods, curry)	152 (9)	96 (<1)	57 (<1)	9 (<1)
Other high fat/salt products (eg, butter, animal fats, high fat savoury sauces)	94 (5)	68 (<1)	29 (<1)	6 (<1)
Sweet breads, cakes, muffins, biscuits, pastries	69 (4)	36 (<1)	34 (<1)	9 (<1)
Flavoured noodles/fried rice products	59 (3)	39 (<1)	20 (<1)	1 (<1)
Savoury snack food with added salt/fat including chips (crisps), coated nuts	40 (2)	30 (<1)	11 (<1)	3 (<1)
Meat and meat alternatives processed or high in salt	40 (2)	27 (<1)	15 (<1)	2 (<1)
Chocolate and candy	31 (2)	13 (<1)	19 (<1)	5 (<1)
Fruit juices less than 98% fruit	6 (<1)	2 (<1)	4 (<1)	2 (<1)
Sweet snack foods (eg, jelly, sugar coated fruits/nuts, tinned fruit in syrup)	3 (<1)	2 (<1)	1 (<1)	0 (<1)
Healthy (core) food category				
Bottled water (unflavoured mineral/sodas)	86 (5)	38 (<1)	53 (<1)	6 (<1)
Meat and meat alternatives, nuts and seeds	58 (3)	35 (<1)	21 (<1)	6 (<1)
Breads, rice and rice products (nothing fried)	50 (3)	26 (<1)	25 (<1)	8 (<1)
Vegetables	43 (2)	21 (<1)	19 (<1)	5 (<1)
Milk, yoghurt, cheese, probiotic drinks	42 (2)	15 (<1)	30 (<1)	1 (<1)
Fruits and fruit juice >98% fruit	40 (2)	21 (<1)	19 (<1)	2 (<1)
Low fat meals (eg, soups, sandwiches, salads, sushi)	34 (2)	20 (<1)	15 (<1)	4 (<1)
Healthy snacks based on core foods (fruit/veg, grain, dairy, meat)	6 (<1)	4 (<1)	2 (<1)	0 (<1)
Low in sugar and high in fibre cereals (<20 g sugar, >5 g of dietary fibre per 100 g)	1 (<1)	0 (<1)	1 (<1)	0 (<1)
Miscellaneous food category				
Tea and coffee	159 (9)	91 (<1)	68 (<1)	11 (<1)
Vitamin/mineral /other dietary supplements, sugar free gum	11 (<1)	6 (<1)	5 (<1)	0 (<1)
Recipe additions including soup cubes, herbs, seasonings	8 (<1)	8 (<1)	0 (<1)	0 (<1)

advertisements identified, 80% (n=1397) were for discretionary (non-core) foods, 8% (n=149) featured branding information only, 8% (n=138) were for healthy (core) foods, 4% (n=70) were for miscellaneous foods. Most food advertisements were located next to a food shop (55%), followed by advertisements on the outside of buses (20%), along the road (12%), on bus shelters (5%), at train stations (5%), at non-food shops (2%) and on buildings (1%). In total, there were more outdoor food advertisements identified along train routes to school (n=1070, an average of 44.6 ads per school) than bus (n=714, an average of 29.8 ads per school) and walk routes (n=134, an average of 5.6 ads per school).

Table 2 shows a breakdown of the content of outdoor food advertisements, stratified by route type. The three most frequently advertised food products along train, bus and walk routes were sugar-sweetened beverages, alcohol and fast food.

There were more outdoor food advertisements located along train and bus routes to school in disadvantaged areas compared with advantaged areas (train routes: 449 food ads in high socio-economic status (SES) areas vs 621 food ads in low SES areas; bus routes: 330 food ads in high SES areas vs 384 food ads in low SES areas).

DISCUSSION

This study found most outdoor food advertisements children were exposed to during the commute to school in Perth, WA were for unhealthy food, with sugar-sweetened beverages, alcohol and fast-food being the most frequently advertised food products. Our study found that on average, commuting to school by train, bus and

walking exposed Perth schoolchildren to 37.1, 22 and 4.5 discretionary food ads per one-way trip to school. This is higher than the average number of unhealthy outdoor food advertisements Sydney children were found to be exposed to while commuting to schools by train (9.6), bus (3.7) and walking (2.3) in a recent study conducted by the Cancer Council New South Wales (CCNSW).¹⁷ A likely reason for this discrepancy is that our study included all outdoor advertisements whereas the CCNSW study did not include outdoor advertisements on shop fronts and sandwich boards. Our study also found more outdoor food advertising present along train and bus routes to schools located in lower socio-economic areas compared with train and bus routes to schools located in higher socioeconomic areas. Socioeconomic differences in outdoor food advertising exposure have also been shown to exist in other Australian research; for example Settle *et al*²¹ found outdoor food advertising at Melbourne transit stops located in more disadvantaged suburbs more frequently promoted chain-brand fast food and less frequently promoted diet varieties of soft drinks.

This study has demonstrated that unhealthy outdoor food advertising is highly prevalent along the commute to school. Given children travel to and from school every day of the school year (approx. 400 trips), this repeated exposure has the potential to influence children's food preferences, food purchasing, purchase requests and contribute to poor health outcomes such as overweight and obesity in both younger and older children.³⁻⁷ Outdoor advertising reaches a large, unrestricted audience as it is highly visible and continuously 'on', so the regulation of its content is particularly important. To date, industry codes of practice on responsible marketing to children have not been effective in

What is already known on this subject

- Exposure to food marketing can influence brand recognition, food preference, consumption patterns and health status in children and adolescents. The food industry is increasingly utilising non-broadcast channels such as outdoor advertising; a rapidly growing form of marketing that reaches a large, unrestricted audience. Therefore, outdoor food advertising may constitute a frequent source of children's exposure to unhealthy food and beverage advertising, in particular, if present along routes to school.

What this study adds

- This study adds to the limited body of knowledge on outdoor advertising exposure and has highlighted that children experience a high level of exposure to unhealthy outdoor food advertisements during their school commute. Concerningly, we found that on average, commuting to school by train, bus and walking exposed Perth, Western Australian schoolchildren to 37, 22 and 4 discretionary (non-core) food advertisements per one-way trip to school, respectively. The majority of these outdoor advertisements were for sugar-sweetened beverages, alcohol and fast-food. Given children travel to and from school every day of the school year (approx. 400 trips), this repeated exposure has the potential to influence children's food preferences, food purchasing, purchase requests and contribute to poor health outcomes such as overweight and obesity in both younger and older children. We conclude that policies which restrict the placement and content of outdoor advertising could be a useful strategy in the fight against childhood obesity.

reducing children's exposure to unhealthy food marketing.^{22 23} A recent international scoping review found existing government-led policies to restrict unhealthy food advertising in outdoor spaces and on publicly owned assets are feasible, and are likely to be effective at improving population diets and health and reducing health inequities, with minimal financial implications.²⁴ Thus, government policies which restrict the placement and content of outdoor advertising could be a useful strategy in the fight against childhood obesity.

The strength of this study includes its application of the INFORMAS protocol, thorough training of research staff in data collection (including inter-rater reliability testing) and thorough encapsulation of all outdoor advertising types and settings (ie, inclusion of shop fronts and sandwich boards). Limitations include its cross-sectional design (ie, quantifying the volume and presence of all outdoor advertisements along theoretical train bus and walking routes to schools at one time point only) and that it is unknown what proportion of these advertisements' children would actually see or notice on their journey to school. Future research employing eye tracking technology and wearable cameras would be helpful to assess this.

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Contributors GT, PH, LET, KK, AS and NW conceptualised the study. Data collection was conducted by NW. NW and GT prepared the manuscript. GT, PH, NW, LET, KK and WB critically revised the paper for important intellectual content. All

authors agree to be accountable for all aspects of this study and approve the final manuscript.

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ORCID iD

Nicole Wickens <http://orcid.org/0000-0002-7202-7187>

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