



A Day in the Life: Exploring Exposure to Unhealthy Food Marketing
in Youth Living in Newfoundland and Labrador through a Novel
Mobile Application

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Abstract

Children are exposed to food marketing in multiple settings, influencing their food attitudes and behaviours. This thesis aimed to test the feasibility of a mobile application to assess food marketing among youth aged 13-17 years (Manuscript 1) and explore youth perspectives and experiences with food messaging (Manuscript 2). Twenty-three participants took photos of food marketing they saw over three days. Each completed a feedback survey on feasibility (ease of use, convenience, responsiveness, navigation, training resources, and willingness to use again) and a focus group sharing their experiences with the app and food messaging. Thematic analyses, descriptive analyses, app-derived feasibility metrics and Fisher's exact test were conducted in Manuscript 1. Results showed high response and completion rates (85.2% and 92%). It also showed high usability and acceptability of the application. Focus groups showed satisfaction with the application's interface and functionality. Photo content analysis and focus group thematic analysis were conducted in Manuscript 2. Focus groups showed that deals, celebrities and characters influenced product purchases. Price-based promotions were the most common marketing indicator in participants' photos (34%). This thesis found that the mobile application has potential for monitoring food marketing across multiple settings and showed how marketing messages encourage unhealthy food intake.

General Summary

Exposure to unhealthy food marketing across physical and virtual environments significantly impacts children's food choices and consumption. Food marketing to children in Canada is mainly self-regulated by the industry; therefore, exploring the nature, extent, and power of food marketing to children across settings is essential. This thesis aimed to test the feasibility of a mobile application to assess food marketing exposures among youth aged 13-17 in NL and explore their experiences and perspectives on the food and beverage messaging they encounter daily. This study found that the FoodMATS-Youth application is highly feasible for monitoring food marketing exposures across multiple settings, e.g. social media, grocery stores, etc. It also showed that marketers employ various techniques in advertisements that appeal to youth, including cost-saving promotions like deals, discounts, or advertisements that contain familiar characters or celebrities. This thesis highlights opportunities for policymakers to use research findings from new tools to inform comprehensive regulations on food marketing to support the health of youth.

Co-authorship Statement

All sections of this thesis have been prepared by Idris Opeyemi Bamigbayan, with edits suggested by Dr. Rachel Prowse, Dr. Laurie Twells and Dr. Kirby Shannahan. The mobile application training for participants was completed by Idris Opeyemi Bamigbayan. The focus group moderation was a joint effort between Idris Opeyemi Bamigbayan and Dr. Rachel Prowse. The data analysis was completed by Idris Opeyemi Bamigbayan, with guidance from Dr. Rachel Prowse. The photo content analysis was completed by Idris Opeyemi Bamigbayan, with photo coding contributions from Dr. Rachel Prowse, Jillian Skiffington and Nan Lei. At the time of submission of this thesis, the manuscripts contained herein have not been published.

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Table of Contents

Abstract.....	ii
General Summary	iii
Co-authorship Statement.....	iv
Acknowledgments.....	v
Table of Contents	vi
List of Tables.....	ix
List of Figures	x
List of Appendices	xi
List of Abbreviations.....	xii
Chapter 1: Introduction and Overview	1
1.1 Poor Diet in Newfoundland and Labrador.....	1
1.2 Factors Influencing Diet	3
1.3 Food Environments and Diet	4
1.4 Food Marketing and Diet.....	5
1.5 Monitoring of Food Marketing	8
1.6 Policy Context of Food Marketing in Canada	9
1.7 Research Gaps.....	10
1.8 Research Objectives.....	11
1.9 Thesis Organization	11
Chapter 2: Literature Review.....	12
2.1 Marketing.....	12
2.2 Food Marketing.....	14
2.2.1 Integrated Marketing Communications	15
2.2.2 Cumulative Food Marketing.....	18
2.3 Food Marketing Techniques.....	19
2.4 Impacts of Food Marketing.....	21
2.5 Food Marketing Monitoring	23
2.5.1 Tools for Monitoring Food Marketing.....	27
2.6 Mobile applications as marketing tools	29
2.6.1 Mobile Applications as Research Tools	31
2.7 Conclusion	32
Chapter 3: Design and Methods.....	33

3.1 Design	33
3.2 Research Paradigm.....	35
3.3 Study Procedures	36
3.3.1 Participants and Sampling.....	36
3.3.2 Data collection	37
3.4 Data Analysis	42
3.4.1 Feasibility of mobile application	42
3.4.2 Youth’s perspectives and experiences of food and beverage messaging in their daily lives.....	43
3.5 Rigor	46
3.6 Ethical Considerations	47
Co-authorship statement for Results Manuscript 1	49
Chapter 4: Results Manuscript 1	50
4.1 Introduction.....	50
4.2 Methods.....	52
4.2.1 Research Design.....	52
4.2.2 Participant Sampling.....	52
4.2.3 Ethics Statement.....	53
4.2.4 FoodMATS-Youth Research Tool.....	53
4.2.5 Data Collection	54
4.2.6 Data Analysis	55
4.2.7 Rigor	56
4.3 Results.....	56
4.3.1 Participant Characteristics	56
4.3.2 App-Derived Feasibility Metrics.....	56
4.3.3 Feedback Survey Feasibility Metrics.....	61
4.3.4 Feasibility based on Focus group themes	63
4.4 Discussion.....	67
4.5 Strengths and Limitations	70
4.6 Conclusion	71
Co-authorship Statement for Results Manuscript 2	72
Chapter 5: Results Manuscript 2.....	73
5.1 Introduction.....	73
5.2 Methods.....	74

5.2.1 Research Design.....	74
5.2.2 Participant Sampling.....	75
5.2.3 Ethics Statement.....	75
5.2.4 Data Collection	75
5.2.5 Data Analysis	76
5.3 Results.....	77
5.3.1 Participant Characteristics	77
5.3.2 Marketing instances submitted	78
5.3.3 Content analysis of marketing instances submitted by participants	80
5.3.4 Focus Group Themes	82
5.3.5 Comparison of Content Analysis and Focus Group Themes	87
5.4 Discussion.....	88
5.5 Strengths and Limitations	92
5.6 Conclusion	93
Chapter 6: Concluding Discussion.....	94
6.1 Summary of Thesis and Contribution to Knowledge	94
6.2 Policy Recommendations.....	95
6.3 Strength and Limitations.....	96
6.4 Future Directions	97
References.....	99
Appendices.....	119

List of Tables

Table 3.1. Locations/settings on the FoodMATS-Youth.....	38
Table 3.2. Summary of outcomes of interest, data sources, and data analyses for this study..	45
Table 4.1. Food marketing submissions by setting and age group.	60
Table 4.2. Mean ratings for feasibility questions and frequency of each rating according to age group.....	62
Table 4.3. Association between age group and rating category	63
Table 5.1. Content analysis of marketing instances	81

List of Figures

Figure 2.1. Integrated Marketing Communications and its Enabling Factors	16
Figure 2.2. Food and Beverage Marketing Monitoring Framework for Canada	26
Figure 3.1. Screenshots of the FoodMATS-Youth	40
Figure 4.1. FoodMATS-Youth Mobile App showing the (a) Home, (b) Data Collection Diaries and (c) Resources	54
Figure 4.2. Flowchart showing recruitment and retention of study sample.....	57
Figure 4.3. Distribution of total submissions.....	58
Figure 4.4. Distribution of submissions by age group	59
Figure 5.1. Examples of marketing instances submitted from (a) digital media, (b) grocery stores, (c) sports and recreation centers, and (d) outdoors.....	79
Figure 5.2. Examples of marketing instances with (a) calls-to-action and (b) price promotions, incentives, or giveaways	80

List of Appendices

Appendix A. Health Research Ethics Board Approval Letter	119
Appendix B. Recruitment Poster	122
Appendix C. Recruitment Email to Community Youth Networks	123
Appendix D. Social Media Recruitment Caption	124
Appendix E. App Training Manual	125
Appendix F. Focus Group Guide.....	137
Appendix G. Consent Form	140
Appendix H. Food Marketing Indicators and Descriptions	146

List of Abbreviations

AMA	American Marketing Association
CCHS	Canadian Community Health Survey
CI	Confidence Interval
CYN	Community Youth Networks
FoodMATS-Youth	Food and Beverage Marketing Assessment Tool for Settings and Youth
GPS	Global Positioning System
HIPAA	Health Insurance Portability and Accountability Act
HREA	Health Research Ethics Authority
IBM	International Business Machines Corporation
IMC	Integrated Marketing Communications
INFORMAS	International Network for Food and Obesity/Non-communicable Diseases Research, Monitoring and Action Support
IOS	iPhone Operating System
IQR	Interquartile Range
NL	Newfoundland and Labrador
OR	Odds Ratio
SMD	Standardized Mean Differences
TV	Television
WHO	World Health Organization

Chapter 1: Introduction and Overview

Dietary habits and patterns are established early in life and influenced by a variety of factors, including food marketing. The consumption of unhealthy foods contributes to the development of numerous chronic diseases and food marketing is a major factor influencing youth's consumption of unhealthy food products. Therefore, it is important to implement policies restricting food marketing to youth.[1,2] To advocate for these policies, we need to collect information on food marketing across the physical and virtual environments.

This thesis aims to test the feasibility of a mobile application to assess food marketing exposures among youth aged 13-17 in Newfoundland and Labrador and explore their experiences and perspectives on the food and beverage messaging they encounter in their daily lives. This chapter introduces unhealthy eating and the health of children living in Newfoundland and Labrador. As a determinant of diet, it also discusses the influences of food marketing and the food environment on unhealthy eating. It explores the current monitoring landscape of food marketing in Canada and the research gaps identified. The end of this chapter outlines the chapters that follow.

1.1 Poor Diet in Newfoundland and Labrador

Poor diets are described as those low in fruits, vegetables, legumes, whole grains, nuts and seeds, milk, fiber, calcium, omega-3 and polyunsaturated fatty acids, and high in red meat, processed meat, sugar-sweetened beverages, trans fatty acids, and sodium.[3] Children who live in Newfoundland and Labrador (NL) have some of the poorest diets in Canada based on school-day dietary quality, a measure of dietary quality assessing nutrient intake and healthiness of food and beverages consumed by children during school and non-school hours.[4,5] Compared to other provinces in Canada, children in NL had the lowest quality diets, according to healthy eating scores of 6 to 17-year-olds in 2004.[5] The maximum score attainable on the healthy eating index was 100 points, with a high quality diet being a score

above 80 points, a diet requiring improvement being a score within 50-80 points and a poor quality diet being a score less than 50 points.[5] The healthy eating score of NL children was 48.4 ± 1.1 points, compared to Nova Scotia, which was the second lowest at 50.6 ± 1.3 points and Quebec which had the highest healthy eating score at 56.9 ± 0.8 points.[5] The mean healthy eating scores improved in 2015 as compared to 2004; however, children in NL still had one of the lowest quality diets with a healthy eating score of 47.7 points.[4] The Canadian Community Health Survey (CCHS) reports that residents of NL aged 12 years and over had the lowest fruit and vegetable consumption of all provinces in 2021, and there was a significant reduction in fruit and vegetable consumption in NL from 17.5% in 2020 to 11.9% in 2021.[6] According to a report by NL's Department of Natural Resources, most wholesalers and retailers reported that only 0-10% of the total vegetables they sell are produced in the province, indicating that the rest are imported.[7] The province's reliance on outside food sources limits the access and availability of healthy foods like fruits and vegetables.[8] In 2016, NL also had the fewest number of farms compared to all other provinces in Canada.[9] Unhealthy eating practices such as overeating, eating rapidly, inadequate consumption of fruits and vegetables, and the consumption of ultra processed foods like sugar-sweetened beverages, crisps, sweet and savory snacks have been described as one risk factor for childhood obesity.[10–12] Childhood obesity is defined as having a BMI above the 95th percentile for age and sex.[13] Newfoundland and Labrador, alongside New Brunswick, had the highest rates of overweight and obesity in youth aged 12-17 in 2022, according to the CCHS. Specifically, 37.5% of the youth in this province are classified as overweight or obese, based on body mass index - higher than the national average of 30.1%.[14] Childhood obesity is a health problem with a high prevalence rate worldwide, and the global prevalence is estimated to increase in the coming years.[15] According to the World Health Organization (WHO), it is a risk factor for respiratory conditions and cognitive impairment in childhood, heart diseases, diabetes, obesity, cancers,

and mental health problems in adulthood.[16] A systematic review and meta-analysis estimated the worldwide economic burden of childhood overweight and obesity to be a \$237.55 increase per capita in annual total medical costs.[17] It also estimated that it resulted in a \$46.38 and \$1975.06 increase per capita for costs in medication and hospitalization. Overall, it projects the annual direct and indirect costs of overweight and obesity to be \$13.62 billion and \$49.02 billion by 2050.[17]

1.2 Factors Influencing Diet

Many factors influence eating habits. These factors include individual determinants such as food preferences and nutritional knowledge; interpersonal influences such as family and peers; physical environments such as food availability and accessibility; social environments such as culture and social status; and economic environments such as income, pricing, and food marketing.[18] Eating habits are formed early in a person's life and usually persist into adulthood. Children's eating behaviours are often actively shaped by parental food habits, choices, and feeding strategies.[19] They are also shaped by socio-economic status and food advertising through electronic and mass media.[19] The WHO reported that unhealthy food and non-alcoholic beverage marketing to children as a part of the current food environment, has an impact on childhood obesity because it significantly influences children's food and beverage preferences and consumption patterns, and there is a need for comprehensive policies restricting marketing to all children under the age of 18 years.[20] An association between unhealthy food marketing and unhealthy eating behaviours, such as increased food intake and preference for unhealthy food products among children and adolescents, has been identified by numerous studies, including systematic reviews and meta-analyses. [21–26]

1.3 Food Environments and Diet

Food environments comprise the multiple levels of physical, sociocultural, economic, and policy contexts that influence people's food consumption choices and patterns. These food environments are influenced by the food and beverage industry, the government, and society in a multitude of ways.[27] These include the type of food products produced, food prices, food marketing, fiscal policies, food availability, retail food environments, and religious and cultural values.[27] The food environment in Canada is highly influenced by the food and beverage industry,[28] which produces foods high in salt, sugar, and unsaturated fats. These poor diets have significantly increased the rate of obesity and diet-related non-communicable diseases (NCDs) in Canada. This disproportionately affects disadvantaged populations in Canada, such as indigenous and low-income communities.[29]

The food environment in NL specifically is influenced by numerous factors. Food is transported over long distances before it reaches numerous parts of the province. This leads to an increase in price and reduced quality of the food products. Disruptions in distribution can also have an influence on food availability.[8] This is a problem throughout the province but worse in rural and more remote parts of the province.[8] The province's geographically dispersed population, remoteness, climate and topography impact food accessibility, availability and affordability.[8,30]

Nutrient-poor and energy-dense food products are cheaper, more accessible, and marketed in Canada, and they make the food environment and people it serves unhealthy.[31] A systematic review and meta-analysis focusing on the influence of the food environment on obesity in adults found that proximity to fast food outlets was significantly associated with obesity (OR=1.15, 95% CI=1.02-1.30, p=0.02).[32] The government and the food and beverage industry are key players that control the food environment and to improve food environments on a macro level, they must be called to action.[27] The food and beverage industry can contribute to a healthier food environment by improving the healthiness of the

foods they produce through partnerships with the government and scientists and by using accurate, unambiguous, and consistent health and nutritional claims.[33] The government also can implement policies, regulations, and actions that aim to increase the food environments' healthiness; these could include restricting advertising of unhealthy food products to children under the age of 17, implementing actions and policies that aim to improve nutrition among equity deserving populations, improve the regulation of health claims and nutrient content claims, and developing and monitoring public targets for sodium, saturated fat, sugar, and fruits and vegetable intake.[31]

1.4 Food Marketing and Diet

According to a 2017 report by the Heart and Stroke Foundation of Canada, food companies spend millions of dollars on marketing unhealthy products to children and adolescents, and these are products high in sugar, salt, and fat.[34] Over the past 7 decades, the rate of consumption of these nutrient-poor processed food products has doubled, accounting for 60% of family food purchases. These products are often the most affordable, accessible, and heavily marketed.[34] In 2019, an estimated \$628.6 million was spent on food and beverage advertising across media in Canada, of which \$492.9 million was spent on advertising unhealthy food products.[35] An estimated \$57.2 million was spent on advertising of child-targeted products and candy/chocolate was the food category with the highest expenditure (30%).[36] Cross-sectional and rapid review studies have found that low socioeconomic groups are more exposed to unhealthy food marketing. [37–39] One of the studies found that participants in the low socioeconomic group, compared to the high socioeconomic group, were more likely to self-report exposure to traditional advertising (OR=1.44, 95% CI=1.00-2.08), digital advertising (OR=1.50, 95% CI=1.06-2.14) and advertising for digital food delivery services (OR=1.47, 95% CI=1.05-2.05).[37] Low socioeconomic groups bear the higher burden of obesity.[40,41] In Canada, obesity rates are 2.2 times higher among women without

a high school diploma, compared to those with a university degree. Similarly, the rates are 1.7 times higher among men with a high school diploma compared to those with a degree.[42]

Authors have found that children and adolescents are exposed to unhealthy food marketing in various settings, including schools, homes (through television and online), supermarkets, recreational centers, and public spaces generally.[43–48] These research studies utilized surveys, recording of mobile device screen, recording of social media use, TV viewership and advertising data, observational audit and wearable cameras. They were conducted in numerous provinces across Canada (British Columbia, Alberta, Nova Scotia, and Ontario), yet they have yet to be conducted in NL. Currently, no research has included NL children in assessing their opinions and experiences of food marketing. While Canada explores a policy to restrict unhealthy food marketing to children, it is essential to include perspectives from Atlantic Canada, especially in NL, which experiences some unique barriers to healthy eating, as described above.

A systematic review and meta-analysis found that exposure to food marketing significantly affect the food consumption decisions of children and adolescents.[49] A meta-analysis of experimental studies reported that for food advertising on TV and advergames, children and adolescents in the advertising group had a higher dietary intake with a mean difference of 57.7 kcal (95% CI=36.61-78.75; $p < 0.01$; $I^2 = 99.7$). [49] Another cross-sectional study found a positive correlation between the frequency of the food advertised on TV and children's consumption of these products ($r=0.66$, $p=0.0001$).[50]

Common food marketing techniques used in traditional media that have been identified in Canada and the rest of the world include children's sports club sponsorships, the use of music and sports celebrity endorsements, events, incentives, games, etc., and food marketing techniques, although widely used, are often understudied. [51–53] Product packaging [54] and misleading claims/labeling[55] are also promotion techniques used to market unhealthy food

products. Instances of these include the use of promotional characters and celebrities on the packaging of unhealthy food products and the use of health claims that portray unhealthy food products as healthy. [55,56] A cross-sectional study conducted in Canada found numerous instances of food marketing on product packaging, including child-appealing visual designs, appeals to fun, appeals to health and nutrition and presence of branded characters or spokespersons.[57] Some child-directed food marketing techniques are specific to marketing through the internet, including viral marketing, website adver gaming, and designated sections for children.[58] Exposure to unhealthy food marketing has also resulted in self-brand connections in children, which increases their attachment to food brands.[59] Self-brand connections occur when people use a brand's "symbolic properties" and meanings to construct or express their identities to others. These symbolic properties are often those of reference groups or celebrities who endorse the brand, which consumers then associate with it.[60]

Ubiquitous unhealthy food marketing in multiple settings and through various channels is referred to as integrative marketing communications, and it can result in children and adolescents developing positive attitudes toward the consumption of unhealthy food products.[61] According to the WHO, repeated frequent exposure of powerful, persuasive, unhealthy food marketing to children will likely increase the impact on children's eating preferences and practices.[62] The Pan American Health Organization reports that unhealthy food marketing "encourages the excessive consumption of energy, sugars, fats, saturated fats, trans fats and sodium," which results in unhealthy weight gain, especially during childhood and leads to overweight, obesity and diet-related chronic diseases.[63] There has been considerable progress by the International Network for Food and Obesity/Non-communicable Diseases Research, Monitoring and Action Support (INFORMAS) on global monitoring of unhealthy food and beverage marketing to children on television,[64] but this constitutes only

a single setting out of the multitude of settings where these exposures are present. It is, therefore, essential to improve monitoring efforts across various settings.

1.5 Monitoring of Food Marketing

Globally, monitoring protocols and templates have been developed by organizations such as the WHO [65] and INFORMAS.[64] These protocols and templates provide guidance on the methods for obtaining data for monitoring food marketing exposures, such as tools and strategies for the recording, coding, and content analysis of advertisements. However, these standardized protocols have primarily focused on TV and digital media, and it is essential for monitoring efforts to extend beyond these settings.[66] Studies have utilized various methods to collect data to monitor food marketing exposures, and some of these include the use of wearable cameras,[67] artificial intelligence on digital media,[68] recordings from television transmissions,[69] and analyzing videos on video game live streaming platforms.[70]

In Canada, the development of the first Food and Beverage Marketing Monitoring Framework for Canada was commissioned by Health Canada.[71] This Framework aims to guide food and beverage marketing monitoring efforts carried out by Health Canada. It outlines the population to be monitored, data collection, outcome measurement indicators, and the scope of monitoring activities. This Framework will be explored in more detail in Chapter 2. Although the broad coverage of marketing across various child settings is recognized, the framework focuses on just six priority settings: television, digital media, schools, convenience stores, packaging, sponsorship of children's sports teams, and sponsorship of children's events.[71] Monitoring efforts globally have not been comprehensive enough, considering the plethora of settings in which children are exposed to food marketing, and this is a gap which needs to be explored.[66]

1.6 Policy Context of Food Marketing in Canada

In Canada, there are no mandatory laws prohibiting the marketing of food and beverages to children. Food marketing to children is mostly self-regulated by the food and beverage industry, with the exception of Quebec.[72] Since 1980, Quebec has prohibited marketing of all kinds to children under the Consumer Protection Act.[73] This policy has had positive outcomes for children and youth who grew up in Quebec, where child-specific advertising is prohibited, as they consumed fast food less often than children in Ontario - a province without such prohibition.[74] A study assessing how the policy in Quebec affects consumption of fast food, as compared to Ontario estimated that it significantly decreased the tendency to consume fast food by 13%.[74] The results only applied to French-speaking households with children in Quebec, and this is expected as English-speaking children in Quebec are more exposed to American stations, making the policy less protective for them.[74] This speaks to the long-lasting impacts of the environment children grow up in – commonly referred to as the life-course perspective.[75] On May 6, 2022, a federal private member's bill, Bill C-252: An Act to amend the Food and Drugs Act (prohibition of food and beverage marketing directed at children), was introduced to the House of Commons.[76] As of May 30, 2024, the second reading of this bill was completed in the Senate. While policymakers debate the scope of such a policy, it is important to explore the breadth of marketing that children are exposed to across multiple settings and techniques because frequent exposure to unhealthy food marketing using multiple techniques is likely to have an increased negative impact on children's eating behaviours.[62] Further, this phenomenon is important to explore to understand how the food industry may adapt to policy changes to ensure public policies continuously protect children's health.

In April 2023, Health Canada released an update on restricting unhealthy advertising to children in Canada.[77] This update acknowledged that Canadian children's diets continue to contain high amounts of sodium, sugars, and saturated fat, and this leads to health conditions

like high blood pressure, obesity, type 2 diabetes, cardiovascular diseases, etc. Restricting advertising to children is rationalized by the contribution of food marketing to an increase in the consumption of unhealthy diets among children. To combat this, Health Canada is proposing that policy restrictions first apply to advertising primarily directed at children under 13 years, present on television and digital media only.[77]

1.7 Research Gaps

To the best of our knowledge, there has not been a single study in Canada to evaluate children's cumulative exposure to unhealthy food marketing across physical and virtual settings, which allows for the possibility of underestimating their exposure and the total impact of marketing.[72] Although two studies[78,79] have focused on food marketing exposures across settings, they only asked participants to capture teen-targeted marketing. A limitation identified in these studies is that teens might overlook marketing that would influence them because they do not perceive it as targeted toward their age group. Some studies have reported food marketing to children in Canada through television [46] via social media [47] and in schools [48], but it is important to note that food marketing to children and adolescents goes beyond these three mediums/settings.[72] Most studies on children's exposure to unhealthy food marketing in Canada either focus on evaluating their exposure in a specific setting or through a specific medium. Despite their vulnerability, youth between the ages of 13-17 are rarely the focus of policies restricting food marketing, as most focus on children aged 12 and under.[80] It is, therefore, important to explore food marketing exposures to this age group across settings and understand how it works in different settings and what techniques are used.

In order to fill gaps related to cumulative food marketing instances across settings, this research tested the feasibility of a mobile application to record food marketing instances across settings and mediums (e.g., convenience stores, grocery stores, digital media, and recreation

settings) in NL and explored NL youth's (13-17 years) perspectives and experiences with food and beverage messaging.

1.8 Research Objectives

1. To test the feasibility (usability and acceptability) of a mobile application to measure exposure to food marketing to youth in NL in their daily life.
2. To explore the use of the mobile application in understanding NL youth's experiences and perspectives on food and beverage messaging in their daily lives.

1.9 Thesis Organization

This thesis is divided into six chapters, including this introductory chapter. Chapter two (2) provides a more in-depth literature review on food marketing, including Integrated Marketing Communications, cumulative marketing, marketing techniques, and the impacts of food marketing; it also describes the current monitoring landscape and tools for monitoring food marketing. It explores mobile applications in marketing and in research. Chapter three (3) provides the overall methodology of this thesis. Chapter four (4) is my first results manuscript which explores the usability and acceptability of a mobile application to monitor food marketing exposures. Chapter five (5) is my second results manuscript which explores NL youth's perspectives and experiences with food and beverage messaging. Chapter six (6) provides an overall summary of this thesis' contribution to knowledge, its strengths and limitations, and some future directions for research.

Chapter 2: Literature Review

This literature review focuses on existing gray and peer-reviewed literature on policies, monitoring, and assessment of food marketing. It consists of discussions on marketing, food marketing, food marketing techniques, impacts of food marketing, food marketing monitoring, and mobile applications. The literature contained herein was found on the Memorial University of Newfoundland Library Database, Google Scholar, PubMed Central, and government and organization web pages such as the World Health Organization, Government of Canada and the American Marketing Association. Some search terms included “food marketing to children,” “advertising,” “food marketing techniques,” “healthy eating,” “food environment,” “poor diets,” “food marketing policies,” “monitoring of food marketing,” “mobile applications for research,” and “integrated marketing and communications.” Experts on relevant topics from my supervisory committee reviewed the content and recommended missing literature as appropriate. No systematic literature screening or data extraction was carried out. This chapter is a narrative review of the evidence on food marketing relevant to the research objective.

2.1 Marketing

Marketing has evolved over the past decades, and has been influenced by numerous factors, including research, innovations, technology e.g., internet and social media, consumer base, consumer needs and policies.[81,82] It evolved gradually since 1936, with more recent and rapid changes occurring from 1996 to date.[83] The evolution has impacted marketing as a discipline[83] and marketing in practice.[81] The central focus of this thesis is on marketing as a practice in the food and beverage industry, but the thesis also draws from the disciplines of marketing and public health. The American Marketing Association (AMA) defined marketing as “the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large.”[84] An important concept in marketing is that of the marketing mix. This

concept is an essential approach to teaching and understanding marketing.[85] The marketing mix was developed by Jerome McCarthy in 1960 and popularized by Neil H Borden in 1964. It refers to a framework consisting of tools, approaches, or strategies put in place to influence consumers into purchasing a product or service, or simply put, “the seller's marketing strategies.”[85] Borden’s elements of the marketing mix of manufacturers consisted of 12 elements,[86] but each of his elements still falls under the popular 4Ps (product, price, placement, and promotion) mix.[85]

Although the most common tools in the marketing mix are the 4Ps, critiques of this mix have sometimes attributed it to a traditional mass marketing approach where brands do not carry out segmentation but attempt to target the entire market with a single product or strategy.[87] The shift from mass marketing to niche marketing led to the development of the 4Cs (communication, consumer needs, cost, and convenience), with each of its concepts corresponding to the concepts in the 4Ps.[87] However, this is an oversimplification of the 4Ps as a seller would use this marketing mix even when they carry out segmentation and offer various products to various audience bases.[85] The American Marketing Association identified the mix as the base of any marketing strategy.[88] McCarthy’s discussions of marketing segmentation emphasized the need for different products for different audiences and the need for the marketing mix to be tailored to the segments. Other authors also state that when the marketing mix is created for a specific market segment, one of the processes is to separate the mix into four component mixes: product, sale, distribution, and communication.[89] This complicates the argument that the 4Ps are a mass marketing approach and have been or need to be replaced by more focused approaches. Looking at the 4Ps more clearly, this thesis focuses on promotion, which the AMA explains as the marketing strategy where businesses utilize various forms of marketing communications and messaging through various channels to reach their target audience and ultimately increase the sales of their products or services.[88]

2.2 Food Marketing

Family food decisions and children's food preferences, practices, and, ultimately, consumption patterns are influenced by their food environments, and these food environments are currently heavily influenced by child-directed food and beverage marketing, which impacts food purchases.[90] Drawing from the WHO's definition of marketing, food and beverage marketing ("food marketing") refers to a company's use of various communication strategies and techniques to draw people's attention towards a food product, influence their perception of it, and promote the consumption of such food products.[62] Food marketing directly influences children's attitudes toward food, their preferences, and their consumption.[2] It has also been implicated as a cause for children's development of positive attitudes towards unhealthy food and the consumption of these products more significantly than they would have if they had not been exposed to food marketing.[2] The food and beverage industry spends billions of dollars yearly on food marketing, and it is important to note that most of the food products being marketed are those high in fat, sugar, or salt.[62]

The WHO defines food marketing by two constructs: power and exposure. The power of food marketing describes the content and design of the marketing message and also the marketing techniques used in its delivery to the desired audience. On the other hand, exposure refers to the reach (how many people see it) and frequency (how many times it is seen) of the marketing message.[62] The impact of marketing is dependent on the power and exposure; thus, the greater the power and exposure, the greater the impact of marketing. [62]

Food and beverage messaging in this thesis refers to the marketing messages and techniques used by food and beverage companies to influence their audience. As described in a previous study, marketing messages refer to the themes and concepts commonly used in text, images, and audio for product advertisements.[91]

2.2.1 Integrated Marketing Communications

Food marketing to children occurs worldwide, and its occurrence is integrated in the sense that brands use messaging through multiple channels to make consumers feel connected to the brand/product.[62] This is referred to as Integrated Marketing Communications. It combines traditional and digital media to deliver the same information in multiple ways to build customer relationships.[92] Due to the complexity of Integrated Marketing Communications, traditional research methods have yet to effectively capture cumulative food marketing exposures.[92] Integrated Marketing Communications is one way that the food and beverage industry maintains its dominance and power in our society. Jackson and colleagues use the critical theories paradigm to explain how this power and dominance influences food marketing to children.[61] Figure 2.1 is an illustration of how two characteristics of Integrated Marketing Communications, subtlety and the use of multiple channels, help maintain the power of the food and beverage industry, using legitimacy and hegemony as enabling factors. The diagram also shows how some macro-environmental factors encourage the industry's use of Integrated Marketing Communications, and Figure 2.1 is a diagrammatic representation of this relationship.

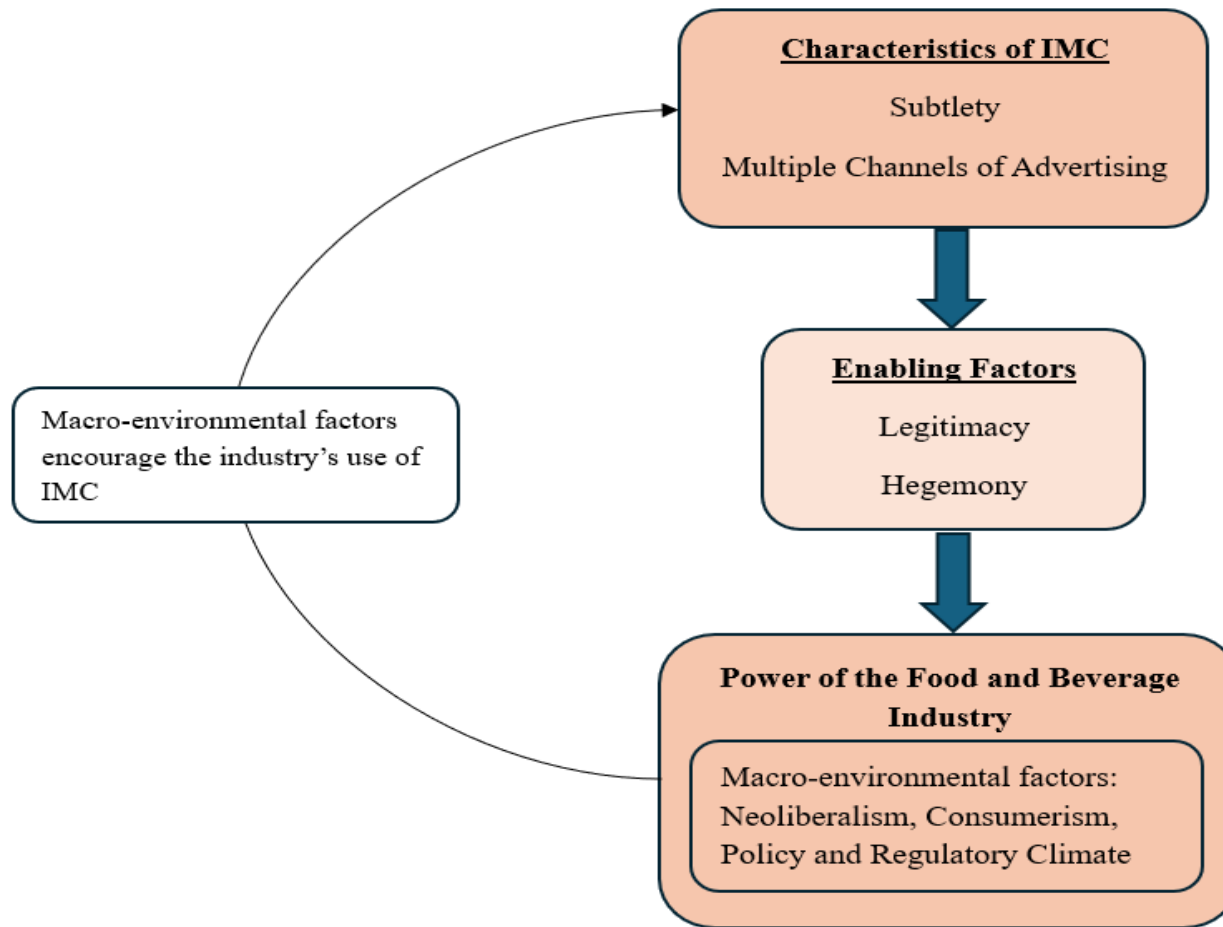


Figure 2.1. Integrated Marketing Communications and its Enabling Factors

(Adapted from Jackson M, Harrison P, Swinburn B, Lawrence M. Unhealthy food, integrated marketing communication and power: a critical analysis. Crit Public Health 2014;24:489–505. <https://doi.org/10.1080/09581596.2013.878454>.)

According to Jackson and colleagues, when consumers recognize the persuasive intent of food marketing, they can protect themselves from being influenced. However, when subtlety is employed as a tactic, it makes it difficult for consumers to recognize the intent of the marketing, let alone protect themselves from it.[93] This is more problematic for children who are unable to recognize the intent of food marketing and are subjected to subtle marketing.[61] As a result of the subtlety being employed, consumers start to unconsciously build a relationship with the brand. The food and beverage industry leverages subtlety to legitimize the position of unhealthy foods within society. Jackson and colleagues describe how the food and beverage industry positions foods and brands to assimilate into cultures, thereby establishing sociocultural connections and credibility for the foods and brands - termed "cultural camouflage." The established legitimacy engrains a cultural significance of the brand/product in the minds of consumers and jeopardizes efforts to make them see it otherwise.[61]

Jackson and colleagues also discuss the use of multiple channels in Integrated Marketing Communications. Food and beverage industries reach consumers across various channels with their marketing messages, and this repeated exposure results in children developing positive attitudes towards unhealthy food consumption.[61] Due to the hegemony of the food and beverage industry, they have much control over the media and over what youth see across various channels. The industry spends more on food marketing campaigns, making it difficult for social marketing messages to reach consumers,[61] especially when significantly more money is spent on advertising unhealthy food products than healthy ones.[35] Marketing from the food and beverage industry is all around children's everyday settings,[72] resulting in youth being more frequently exposed to food marketing messaging than public health messaging.[61]

The policy and regulatory context of marketing in Canada allows the food and beverage industry to freely market products. Food marketing to children is mostly self-regulated in Canada, except for Quebec, and two scoping reviews have stated that the current regulations have been insufficient in reducing children's exposure to food marketing.[72,94] Self-regulation of food marketing to children is insufficient because the industry still finds loopholes to target children with advertisements and there has been no improvement in children's food marketing exposure as a result.[72,94,95] The policy climate thus accords authority to the food and beverage industry, enabling unhealthy food marketing, especially the use of Integrated Marketing Communications. Consumerism and neoliberalism are also other factors that reinforce the power of the food and beverage industry.[61] Consumerism refers to the development and promotion of a society that encourages overconsumption as a means of economic growth and attaining personal well-being.[96] Marketing has been used to influence consumerism, and this includes the marketing of unhealthy food and beverage products to children.[61] Neoliberalism, on the other hand, is an ideology that emphasizes that individuals are responsible for their own well-being.[97] The food and beverage industry frames obesity as an individual problem arising from poor lifestyle choices made due to individual knowledge or culture rather than as an effect of the food environment.[98]

2.2.2 Cumulative Food Marketing

Cumulative food marketing is a phenomenon that describes how exposure to multiple episodes of marketing over time may have a more significant impact on food attitudes, preferences, and consumption behaviours than a single exposure.[2,22,72,99,100] This is a research gap that needs to be explored in greater detail as it would explain the long-term effects of food marketing and the impact of repeated exposures.[2] Although Jackson and colleagues briefly discuss this concept within the context of Integrated Marketing Communications, there

are some nuances. Their discussion primarily explains cumulative marketing as an aspect of Integrated Marketing Communications related to children's exposure to a brand's messaging across various platforms. However, this concept is associated but broader when it is children's everyday exposure to food and beverage marketing across multiple settings and media,[67] that is, not limited to one brand's utilization of marketing across settings but including all of the marketing instances children experience daily across settings and media. It is essential to approach these concepts carefully as Integrated Marketing Communications majorly describes a marketing technique used by food brands. In contrast, cumulative marketing represents a collection of the marketing exposures faced by children daily, beyond a single food brand. The use of Integrated Marketing Communications by numerous food brands will result in children's cumulative exposure to food marketing, resulting in children's gradual acceptance of unhealthy food products.[101] For example, children's exposure to Cadbury's Freddo Frog character on the product packaging, point-of-purchase displays, online games, websites, and events will constitute Integrated Marketing Communications.[101] In contrast, children's exposure to advertising from numerous chocolate or candy brands across multiple channels is cumulative marketing.

2.3 Food Marketing Techniques

Marketing techniques are used when food products are being marketed through multiple channels like television ads, websites, print media, social media, video games, and in-store marketing.[102–104] There is a multitude of marketing techniques used by the food and beverage industry to advertise to children. Some core marketing techniques that independently target children and appeal to them can be used on product packaging. These include child-appealing visual designs, cartoon characters, celebrities, licensed characters, branded characters, fun appeal, toys or prizes, giveaways, games/activities, children/families, and

unconventional shapes, flavours, or colours of the products.[105] These techniques are also used across other channels.[102–104] It has been found that these persuasive marketing techniques are more frequently used to advertise unhealthy food products to children than other food products.[104]

Children under the age of 17 are particularly vulnerable to these food marketing techniques because they often cannot recognize the intent of marketing or separate it from the rest of the content they are exposed to.[106] Food products advertised using these marketing techniques are usually preferred by children more than those without, and this is associated with an increase in the consumption of unhealthy food products.[107] The techniques used are sometimes targeted toward age groups, with children and adolescents being targeted with ads that appeal to their respective age groups more.[53] Teenagers have also been identified to have a higher exposure to marketing techniques overall.[108] Some food marketing techniques are not direct, these include donations from food and beverage companies and sponsorships of children's sports, activities, and events.[109] Food marketing techniques in the digital space also sometimes vary from traditional marketing.[110] Taking advantage of the creative abilities of digital media, some newer techniques being utilized include the development of food-themed game apps, paid partnerships with streamers, vloggers, or influencers popular among children, and word-of-mouth social media communication among friendship networks.[110] Using digital analytics, marketers analyze consumer reactions and facial emotions in real-time to determine when, how, and what kind of ads to deliver to each consumer. This is referred to as neuromarketing.[110] Current digital marketing techniques are comparable to companies having a personal marketer for each child, identifying the most susceptible, encouraging them to share marketing messages, and providing recommendations on the nearest locations to purchase foods.[110] It is, therefore, essential to explore the power of food marketing as part of monitoring efforts, to identify the persuasive techniques used by the food and beverage

industry, and to advocate for and evaluate the impact of policies that aim to protect children.[66]

2.4 Impacts of Food Marketing

According to a narrative review conducted by the WHO[1], unhealthy food marketing influences children's and adolescents' beliefs and attitudes towards food, affects their eating behaviours, influences family food purchase decisions, and ultimately results in the overconsumption of unhealthy food products.

Beliefs and attitudes towards food: A systematic critical review reported that food marketing has resulted in children under 18 years developing positive attitudes towards unhealthy food products.[2] In an experimental study, children (7-11 years) exposed to commercials for unhealthy food products containing nutrition and physical activity messages (e.g., fruit images, reference to vitamins) rated those products as significantly healthier (Partial $\eta = 0.12$, 95% CI: 9-10.68, $p = 0.003$) compared to children who viewed unhealthy food commercials with a different message (e.g., humour, fun) or healthy food commercials.[111] This shows how advertising can lead to children perceiving unhealthy food products to be healthier than they are.

Food preferences: Marketing techniques like the use of branded characters have been found to influence children's preferences and choices, with children being more likely to prefer and choose food products with branded characters than products without them.[112] The experimental study found that of the three products selected (Pom-Bear potato snacks, Cheestrings, and CocoPops snack bar), children (4-8 years) had a significant preference for Cheestrings ($Z = -3.225$, $p = .001$) and Coco Pops Snack Bars ($Z = -2.245$, $p = .025$) when they had a brand character, compared to the same products in packaging without a character.[112]

Family food purchase decisions: A systematic review reported that parents sometimes buy food products based on their children's requests, and these requests are influenced by food marketing.[113] A study assessing food marketing to children (3-16 years) found that most parents had experienced their children requesting food products during shopping trips, most of them (88%) being unhealthy, e.g., chocolates, cakes, and biscuits.[114] It reported that most parents bought at least one of the requested food items. These parents also cited food marketing (packaging, checkout displays, and recalls from TV advertisements) as one of the major enablers of these requests and expressed the need for a reduction in child-directed marketing. This shows how the food and beverage industry takes advantage of children's pestering power to influence family food purchase decisions.[114]

(Over)consumption of unhealthy food products: A systematic review and meta-analysis conducted to estimate the effect of food marketing exposures found that children aged under 18 years exposed to the marketing of unhealthy food products in experimental conditions were significantly more likely to consume those products than those not exposed (SMD: 0.56, $p = 0.003$, 95% CI: 0.18-0.94, $I^2 = 98\%$). The authors also noted that their study only reviewed studies that used one-time experimental exposures; therefore, cumulative marketing is likely to have an increased effect on unhealthy food consumption in real life.[115]

Impact on health: The WHO reports that food marketing is associated with an increased risk of obesity in children aged under 18 years, through its influence on their food preferences and consumption.[20] Overweight and obesity are indirect outcomes of food marketing, and they occur gradually over time; it is, therefore, difficult to carry out longitudinal studies on the effect of food marketing on weight outcomes.[99] A study that analyzed datasets from longitudinal surveys estimated that increasing exposure to fast food advertising to adolescents (12-18 years) increased the probability of boys being overweight by 17% and girls by 4%.[116] Despite numerous evidence pointing to the negative health effects of unhealthy

food marketing, the industry denies a need for regulatory intervention in food marketing, citing the absence of a causal relationship between food marketing and obesity.[117]

2.5 Food Marketing Monitoring

Food and Beverage Marketing Monitoring Framework for Canada

This framework, commissioned by Health Canada, was developed through rigorous literature reviews of existing monitoring frameworks and engagement with Canadian and International researchers and experts.[71] This comprehensive framework guides Health Canada's food and beverage marketing monitoring efforts. It has seven key areas, which are discussed below (see Figure 2.2 for framework summary).

Questions to be answered: There were four significant questions to be answered by this monitoring framework. The first is identifying children's exposure to unhealthy food marketing across settings and mediums. This question has three other sub-questions, including making comparisons between the frequency of exposure to unhealthy food marketing and other food marketing, identifying food categories that are the most marketed, measuring children's actual exposure to unhealthy food marketing across settings, and identifying the major sources of these exposures. The second question focused on identifying what marketing techniques the food and beverage industry uses to target children, while the third and fourth questions focused on the changes to the practices of the food and beverage industry and the changes to attitudes, behaviours, and health of children, respectively.[71]

Populations to be monitored: The framework focuses on monitoring food and beverage marketing exposures to children and adolescents (2 to 17 years old). The proposed marketing regulation in Canada aims to restrict marketing to children under the age of 13; therefore, monitoring food marketing to this age group will help assess the impact of this proposed regulation. Monitoring exposures to adolescents over the age of 13 would help assess if the

food and beverage industry is targeting this age group more due to regulations around marketing.[71]

Geographic location of monitoring: Considering the fact that the nature and extent of food marketing may vary by region, the framework suggests monitoring food marketing in all provinces and territories in Canada. In each region, data should be collected in urban and rural areas to account for the potential variance between marketing in rural and urban settings. Data would also be collected across various socioeconomic areas.[71]

Scope of monitoring activities: Although the framework recognizes that all child settings and media should be monitored, numerous constraints will limit this possibility. Therefore, it was recommended to prioritize environments/media where children spend the most time, advertisers spend more to advertise in, children are often targeted, and where there are existing monitoring methodologies. The framework identifies these settings/media/techniques as television, digital media, schools, convenience stores, packaging, sponsorship of children's sports teams, and sponsorship of children's events.[71]

Indicators to be monitored: This framework included three types of outcome measurement indicators, namely, food marketing indicators, company-level indicators, and behavioural and health-related indicators. The food marketing indicators aimed to assess the exposure and power of food marketing to children and the healthfulness of the foods being advertised. Company-level indicators focus on food companies' marketing expenditures in various settings/media and their food sales. The behavioural and health-related indicators focus on short-term impacts of marketing like advertising recall, purchase intent, children's food requests, etc., and long-term impacts like food intake, food preferences, and obesity.[71]

Methodologies for data collection and data sources: Methodologies for data collection and data sources: This monitoring will include both quantitative and qualitative methodologies. The data collection methods will be specific to the indicators and the settings/media being

monitored. Food marketing indicators can be assessed using data collection tools that have been piloted to ensure suitability. Data collection protocols that have already been developed can also be utilized. Company-level indicators can be assessed using data provided by the companies or through licensed data. Finally, behavioural and health-related indicators can be assessed using current national surveys and by including more specific variables in the surveys.[71]

Timing of data collection and reporting: The suggested timing of data collection and reporting is dependent on the indicators being measured. First, data should be collected on all of the indicators at baseline for ease of comparison after policy implementation. Food marketing indicators are to be collected annually at two different points in the year while also accounting for weekday and weekend monitoring. Company-level indicators should also be collected annually. Behavioural and health-related indicators should be collected based on the outcomes, which is every two years for the short-term outcomes and in the final year of the monitoring cycle for the long-term outcomes. The data collected should be reported annually or at the end of the monitoring cycle.[71]

This thesis contributes to monitoring of food marketing in Canada by providing a snapshot of the marketing instances that youth 13-17 years are exposed to across various channels and settings in Newfoundland and Labrador. It also identifies the marketing techniques used by the food and beverage industry to target children. This thesis provides data from this province which is one of the locations of monitoring and covers all channels and settings within the scope of the monitoring framework. Finally, it has the potential to lead to the development of a digital data collection tool that can be used to collect and assess food marketing indicators in this province and across Canada.

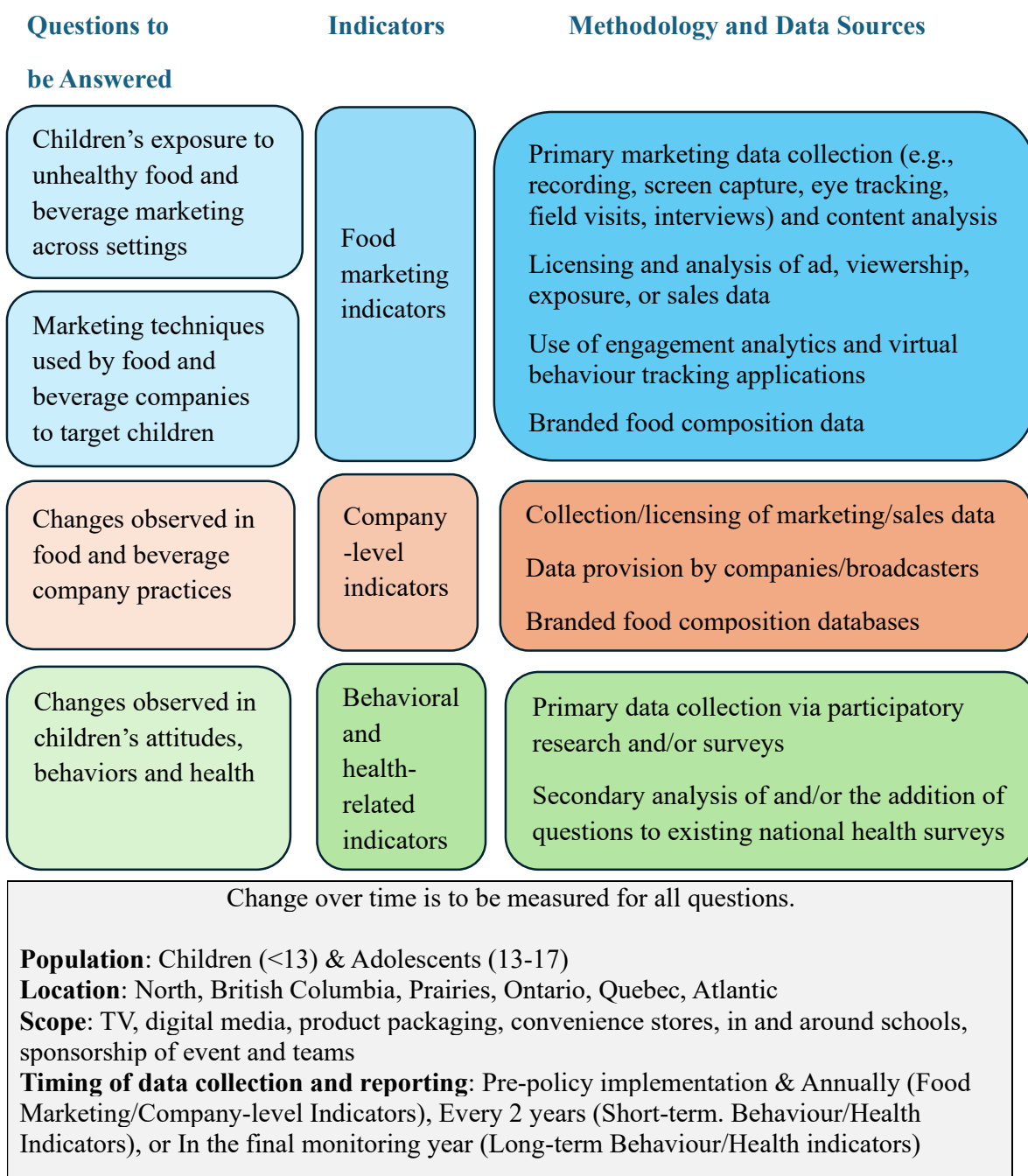


Figure 2.2. Food and Beverage Marketing Monitoring Framework for Canada

Adapted from Potvin Kent M, Mulligan C, Pauzé E, Pinto A, Remedios L. The food and beverage marketing monitoring framework for Canada: Development, implementation, and gaps. *Food Policy* 2024;122:102587. <https://doi.org/10.1016/J.FOODPOL.2023.102587>. License: <http://creativecommons.org/licenses/by-nc-nd/4.0/>

This framework informs Health Canada's Marketing to Kids (M2K) Monitoring Strategy. The Health Canada M2K Monitoring Strategy involves the department's monitoring of children's environments where they can be exposed to food marketing and the techniques

commonly used by the food and beverage industry to target children.[77] This will provide data on food marketing exposure to establish baseline data that can be used to understand food marketing trends in Canada over time.[71,77] This strategy has been instrumental to food marketing monitoring efforts in Canada through supporting and funding projects that study the exposure and power of food marketing to children across the country.[71] This includes marketing through TV, social media, packaging, recreational settings, and food retail environments. This strategy also monitors the industry's practices, and this has been done by examining the advertising expenditures of the food industry on various channels. Also, it supports research identifying how food marketing influences children's attitudes, behaviours, and health.[71]

2.5.1 Tools for Monitoring Food Marketing

Monitoring protocols have been developed by various organizations to monitor unhealthy food and beverage marketing worldwide. We have the ones from WHO Europe,[65] INFORMAS,[118] Consumers International,[119] Nordic Council of Ministers.[120] These protocols focus on supporting researchers, governments, organizations, and regulatory bodies in monitoring the nature and extent of food marketing to children. It guides countries in collecting data on the food and beverages being advertised, the frequency of exposure, and their power. This helps them gather evidence on unhealthy food marketing exposures to children through various settings, which can then be used to advocate for policies around food marketing to children.

These protocols usually guide sampling designs for monitoring, recording, coding, and analyzing advertisements. Some protocols, like the Nordic Council of Ministers [120] and the Consumers International protocol,[119] also provide guidance on how to report the findings of monitoring efforts. These protocols cover a range of settings like TV, websites, social media, magazines, cinemas, games, schools, sports arenas, packaging, etc. The WHO's Regional

Office for Europe developed protocols to monitor food marketing on TV and digital media,[65] while INFORMAS has currently developed protocols for TV[118] and outdoor advertising in school zones.[121] Only the Nordic Council of Ministers and Consumers International protocols provided methods for monitoring across numerous settings, whereas others specifically focused on TV and digital media. It is, however, important to note that some manuals are more comprehensive than others, and sometimes, the same manual has more comprehensive methods for some settings than others. For example, the Nordic protocol provided a more comprehensive method for TV and in-store advertising monitoring than its methods for cinema.[120] Although the INFORMAS protocol for TV monitoring only focused on spot advertisements during and between TV programs, it is much more detailed and comprehensive than the TV monitoring methods from the Nordic Council of Ministers and Consumers International protocols.[118–120]

The methods used for data collection vary according to the setting of marketing (e.g. TV, print media, etc.). While some methods can only be used for specific settings, some are more versatile and can be used to collect food marketing data across settings. One such versatile method is crowdsourcing. Crowdsourcing data for monitoring involves contributors taking and uploading photos of food marketing to a mobile application or website created for that purpose.[66] Other methods recommended in the numerous protocols currently used in research include video recording of television broadcasts, screenshots of advertising on streaming TV, scanning publications in print and digital media, researchers taking photos of advertising in indoor and outdoor settings during field visits, etc.[118–120] Another study in Canada used a mobile application to collect data on teen-targeted food marketing.[78] Much of the global food marketing monitoring focuses on exposure on TV and digital media, which contributes to the abundance of evidence on food marketing in these settings.[66]

One major limitation of food marketing monitoring in digital media that has been identified is the inconsistencies in methodology used,[122] which is why comprehensive, detailed, and efficient frameworks and protocols are needed to make them more consistent across studies. This is not an issue limited to digital media, so similar efforts should be put in place for other settings where children are exposed to food marketing. The importance of the evidence on food marketing on TV and digital media cannot be overstated; however, this can limit advocacy for regulations and restrictive policies to just these settings.[66] This is already in play in Canada [77] and shows the need for more detailed monitoring of food marketing exposures to children across all settings.

2.6 Mobile applications as marketing tools

Mobile applications have numerous applications in the marketing field, including sales, promotional purposes, customer engagement, customer insights, analytics, interactions, etc.[123,124] In the food and beverage industry, apps are also used for these reasons, as food and beverage is one of the most popular apps used for online ordering.[125] Mobile applications offer effective and often personalized communication channels with customers, and they have become a go-to for customer engagement.[126] Mobile applications also provide customized services to users based on their shopping preferences, age, location, etc., increasing customer purchase and satisfaction.[127,128] This also helps brands target users with personalized advertisements based on analyzed interests or personal information.[129] Apps are also used to attract new customers and maintain brand loyalty among current ones.[130,131]

Many Canadian food and beverage companies have mobile applications, and these companies are usually fast-food chains or dine-in restaurants that use applications for mobile ordering and the promotion of their food products to consumers.[132] Fast food restaurants collect personal data of users of their applications, and these users are sometimes children.

Even though some fast-food companies in Canada claim that their applications are not intended for children, they do not limit children's usage of their applications as there are no age verification processes.[132] This is concerning as personal information collected from applications might be used for targeted marketing advertisements. Fast food restaurants also sometimes collect data from applications that show children's food preferences and consumption patterns.[132] It is important to understand how mobile applications work as they are increasingly being used as a means of food marketing.

An integrative review by Lara Stocchi and other researchers analyzes how mobile applications shape the customer experience in three stages: pre-adoption, adoption, and post-adoption. These stages are essential to the customer experience and determine whether customers receive value from the app.[124]

Pre-adoption: The consumer's initial decision-making process on whether to adopt an application is influenced by the technological features and benefits they seek and their individual characteristics.[124] In the pre-adoption stage, there is a wide range of benefits and features that consumers seek from an app, and they include usefulness, ease of use,[133] novelty,[134] compatibility, convenience,[135] etc. These benefits/features influence the consumer's intention to download or adopt an app, but there's a lack of evidence about which ones make the most impact.[124] Individual characteristics that have an influence in the pre-adoption stage include consumer experience,[136] past behaviour,[134] self-efficacy,[137] lifestyle,[138] innovativeness,[139] etc.

Adoption: The adoption stage is a continuation of the decision-making process to adopt an app. The benefits and features consumers seek from the pre-adoption stage are also essential to maintain in this stage.[124] Mobile application adoption in popular apps like lifestyle applications, games, and applications linked to retailers is characterized by mobile shopping via apps and in-app purchasing, as these two behaviours signal the adoption.[124] These

behaviours are driven by numerous factors, including flexibility,[140] presence of product promotions, interactivity,[141] and perceived mobile application value.[142]

Post-adoption: The post-adoption stage talks about ongoing application usage, outcomes for the application, and outcomes for the brand. Focusing on the consumers, ongoing application usage is determined by application stickiness and engagement.[124] Application stickiness usually depends on numerous factors, including loyalty, satisfaction, and perceived value, which could be price, performance, social, or even emotional.[143] Stickiness could also be determined by consumers' perception of the app's design and functionality. On the other hand, application engagement is influenced by technical convenience and customer sociability.[144] It is also driven by effort expectancy, social influence, and brand identification.[145]

2.6.1 Mobile Applications as Research Tools

Mobile applications are increasingly being used in research as data collection tools.[146] They are often used in quantitative studies but less in qualitative studies, despite their potential to improve the qualitative research process for participants and researchers.[146] Applications can be very essential tools in studies with qualitative methodologies, as this can help collect data in real-time, especially providing an avenue for studies using the daily diary method.[146] Diary studies involve participants documenting specific events, experiences, or actions that happen over the course of a typical day in their lives.[147] Diary studies have come a long way, from paper and pencil diary entries when this method was first used to electronic diary entries in recent times.[147] Although limited in literature, mobile apps are increasingly being used in qualitative studies that use interactive methods like electronic diaries and photography.[148]

Although this is a valuable tool that could significantly improve qualitative research, it has its limitations. First, mobile application use in research can exclude parts of the population

that do not own a smartphone.[146,148] Also, in some cases, participants might own smartphones that are not compatible with the specifications of the app. For example, earlier models of smartphones might not have the supported operating systems or might not have the required software version for the mobile application.[146,148] This further excludes more participants from the study. Another limitation is the technical issues participants can experience when using the mobile app, such as the app not providing enough space for participants to complete entries, the absence of a “back” button for participants to return to a previous screen, the absence of an option to edit previous submissions and participants’ inability to view already submitted entries.[148] These can result in participants engaging with the application less than required or dropping out of the study altogether.[148] Mobile data usage can also be a significant limitation of application usage. Participants without Wi-Fi connections might have to use apps and provide responses using their mobile data, which could be expensive for participants.[146] The cost to the researcher is also important to consider. Developing a mobile application for a research study, especially a small one, is expensive.[146,148] This does not change when an application is not developed from scratch either, as it is still expensive to adapt an existing application for a research study.[148]

2.7 Conclusion

In conclusion, this literature review shows that food marketing influences children's attitudes and behaviours toward food. This shows the need for policies restricting food marketing to children. Data on the nature and power of food marketing is important to advocate for these restrictive policies. The necessary data on cumulative food marketing across media and settings is hard to capture as most studies have focused on food marketing across single settings, e.g., TV and social media. As this review explored, mobile applications are essential not only as research tools but also as data crowdsourcing tools, and they can be used to collect data on cumulative food marketing exposures.

Chapter 3: Design and Methods

This chapter reviews the overarching methodological approach to the thesis. The overall study design, research paradigm, and new research tool are discussed in detail along with study procedures. The tool design, pretesting and use in the study are reviewed. Data analyses are described for the outcomes of interest. Steps to maintain data quality and rigor in the research, and ethical considerations are discussed. Methodological details relevant to each results chapter are also included in Chapters 4 and 5, as appropriate.

3.1 Design

This study was a feasibility study testing a new mobile application for capturing food and beverage messages. It was a convergent (QUAL+QUAN) mixed methods study where both quantitative and qualitative data were collected and analyzed concurrently, and no component informed the other.[149] This is a focused ethnography[150] that utilized photo elicitation in focus groups to explore food marketing instances experienced by NL youth in their daily life and to better understand their perspectives on food and beverage messaging. The choice of focused ethnography as the study design for this thesis was informed by my research objectives, to understand NL youths' experience with and perspectives on food messaging. Focused ethnography, as opposed to traditional ethnography, is often used to address a specific issue in a specific context (i.e., food marketing in the case of this research), among a specific group of people (i.e., youth in this case), and it allows for the researchers to have predetermined research questions they seek to answer.[151] According to Higginbottom and colleagues, participant observations can be limited, replaced, or eliminated in focused ethnographies.[150] Observations can be replaced with other approaches that elicit participant views. Focused ethnographies in healthcare have utilized individual interviews, focus groups, observations, and vignette interviews.[150,152,153] A similar focused ethnography also used photo-based inquiry to examine parents' perception of food and beverage marketing in and around their

children's sports and recreation facilities.[154] This study found that parents had an increased awareness of food marketing in the recreation facilities due to the photo-taking activity. It also reported that parents believed that the unhealthy food and beverage products being marketed in these settings were inconsistent with the healthy lifestyles that these settings promote.[154]

This study influenced the use of photo-elicitation in focus groups, as participants' own photos of food marketing provide an avenue for participants to go into details of their personal experiences of food marketing and not just dominant perspectives. Focus groups can be utilized in ethnographic research to better understand participants,[155] and combining photo-elicitation with these focus groups can be useful in ethnographic studies.[156] It is, therefore, a part of this focus ethnography, rather than being standalone. This design provided insight into how food marketing across multiple settings is perceived in teen culture. The focus groups enabled us to deeply understand the youth's collective and individual beliefs, ideas, and opinions on the food ads they see daily, especially in Newfoundland, which has a unique food culture. The selection of focus groups over interviews for this study was based on their effectiveness in exploring the collective experiences of participants[157] (e.g., food marketing to youth) and in identifying both inconsistencies and agreements within the group.[158]

This study builds on existing work undertaken at Memorial University of Newfoundland, funded by Health Canada as part of a portfolio of projects to monitor food marketing to children in Canada. I created a mobile application on a platform utilized by my MSc supervisor to document food marketing exposures in recreation centers across Canada.[159] This application is a youth-focused data collection tool to collate significant instances of unhealthy food marketing in their daily lives. I further explored youth beliefs and opinions on food marketing and their experiences with food marketing in everyday life.

3.2 Research Paradigm

The focus of this research is situated within the critical theory paradigm. The critical theory paradigm examines how a phenomenon is influenced by power structures, especially historical, political, and economic structures. Critical theory highlights these influences and focuses on identifying what changes could be made to existing structures and how these changes can be achieved through societal responsibility.[160] Looking at food marketing using a critical theory perspective would mean examining how the food and beverage industry, as a power structure, influences people's ideas and opinions about food and maintains dominance over conversations on food and food consumption.

Critical theory does not and should not have fixed characteristics as it continuously evolves and might require constant adaptation depending on the phenomenon or population at the base of the inquiry.[161] Broadly, the ontology of the critical theory paradigm is that of historical realism, which means people's view of reality is shaped by socio-cultural, economic, and political values. [162,163] The political influence of the food and beverage industry is significant.[61] One of the major barriers to nutrition policy change is pressure from the food industry in its many forms. This includes intense lobbying, industry-government partnerships, and influencing cultural norms through the media.[164] Food marketing to children is self-regulated by the food and beverage industry in some countries, including Canada, and it has been found that this self-regulation has not been effective in reducing children's exposure to food marketing. [72,165–167] My decision to situate this research in critical theory over other theories is influenced by its focus on power structures and their impact, as well as its advocacy for change. Poor food environments often result from the food industry's power to influence policies and regulations, as identified above. It is, therefore, crucial to conduct research that prioritizes children's health over the interests of the industry.

The epistemology of the critical theory paradigm is transactional and subjectivist. It maintains that findings depend on the positionality and values of the researcher. A researcher's

inquiry and/or interpretations of findings are influenced by their prior knowledge or experiences. Therefore, knowledge is co-produced or co-constructed by the researcher and participant during the research process, and it is not an objective discovery by the researcher. Its methodology is also dialogic and dialectical. This involves using approaches that promote logical discussions between the researcher and the participants. [162,163] Utilizing focus groups and photo-elicitation for this research is in line with the methodological stance of the critical theory paradigm. Photos of food marketing submitted by the participants will be used to facilitate discussions to explore their experiences with food marketing and the feasibility of this method to examine youth's cumulative exposure to food marketing.

3.3 Study Procedures

3.3.1 Participants and Sampling

Eligible participants were youth aged 13-17 years living in NL who had access to a smartphone and were willing to participate in the study. Participants were recruited through Community Youth Networks (CYNs) and social media advertisements on Facebook and Instagram. Community Youth Networks is an initiative established by the Government of NL that provides developmental programs and services for youth (12-18 years) throughout the province. These networks shared our study poster and information with members and had them contact the research team or complete the demographic survey. Due to this recruitment strategy enrolling mostly younger adolescents aged 13-14 years, we submitted an ethics amendment application and received approval to launch targeted social media ads on Facebook and Instagram which enabled the recruitment of older adolescents. Younger participants aged 13-14 years provided parental consent and youth assent for this study, while the older participants aged 15-17 years provided their own consent. Participants were recruited across the province, from both the rural and metropolitan parts of NL. At the end of the study, each participant was

offered a \$30 e-gift card as a thank-you for their time and effort throughout the study, regardless of whether all study activities were completed.

Purposive sampling was used to select participants. Purposive sampling is the most commonly used sampling technique in focused ethnography as it seeks to enroll participants who have specific knowledge or experience of interest.[150] Twenty-three participants used the mobile application (twelve 13–14-year-olds and eleven 15–17-year-olds), and twenty-two of them attended the focus group, with the exception of one 13-14-year-old. Each participant attended one focus group based on their age group. A sample size of twenty-four was chosen based on similar photo-based studies in Canada that had achieved data saturation with sample sizes of eleven[154] and twenty-four.[168] In addition, this is a pilot study, and a sample of 24 was sufficient to achieve the purpose of the study.

3.3.2 Data collection

FoodMATS-Youth Tool Design

This study used a mobile application to capture cumulative food marketing instances. Our data tool, the Food and Beverage Marketing Assessment Tool for Settings and Youth (FoodMATS-Youth), collected GPS-tagged data on food marketing instances that youth experienced across various settings and explored their perceptions of food marketing strategies targeted at youth. The settings included in the mobile application are included in Table 3.1 below:

Table 3.1. Locations/settings on the FoodMATS-Youth

1.	Home
2.	Grocery Store
3.	School
4.	Convenience Store
5.	Shopping Mall
6.	Fast Food Restaurant
7.	Sit-down Restaurant
8.	Recreation and Sport Centre
9.	Movie Theatre
10.	Youth Centre
11.	Public Transportation
12.	Social and Digital Media
13.	Other Locations

The mobile application could be used offline, and when it was, information was stored on the servers and submitted once the devices had reconnected to Wi-Fi. The application was produced by MetricWire, a Canadian software application company with a record of facilitating digital health research.

Procedure

Interested participants were asked to download the Catalyst by MetricWire application and use the FoodMATS-Youth tool to complete personalized diary entries where they uploaded photos of marketing instances and answered a series of questions on the marketing features each time they saw food marketing over three days (two weekdays, one weekend). These questions were developed in alignment with Health Canada's list of food marketing indicators.[169] The diaries are tiles/options in the mobile application where each setting/medium has a tile assigned to it and has a cover image representative of that location, i.e., A photo of a classroom was used as the cover image for the tile assigned as the diary for school (see Figure 3.1 and Appendix E for screenshots of the FoodMATS-Youth). The application enabled real-time data collection by providing a platform for study participants to

engage in a study with their smartphones. The MetricWire application has also been used for data collection in another mobile diary study that assessed health behaviours.[170] The application included reminders and instant messaging to prompt participants to complete their diaries and on-demand help from the research team if issues arise.

Feedback Survey

At the end of the three days, a 5-minute usability feedback survey was sent to participants to assess their opinions on the usability and acceptability of the application and the data collection process. This feedback survey was hosted on the mobile application, and participants answered it directly on the application as one of the current tasks (see Figure 3.1). The data obtained from this data collection process (photos and marketing indicators) provided information on the nature of food marketing across the various settings captured using the application.

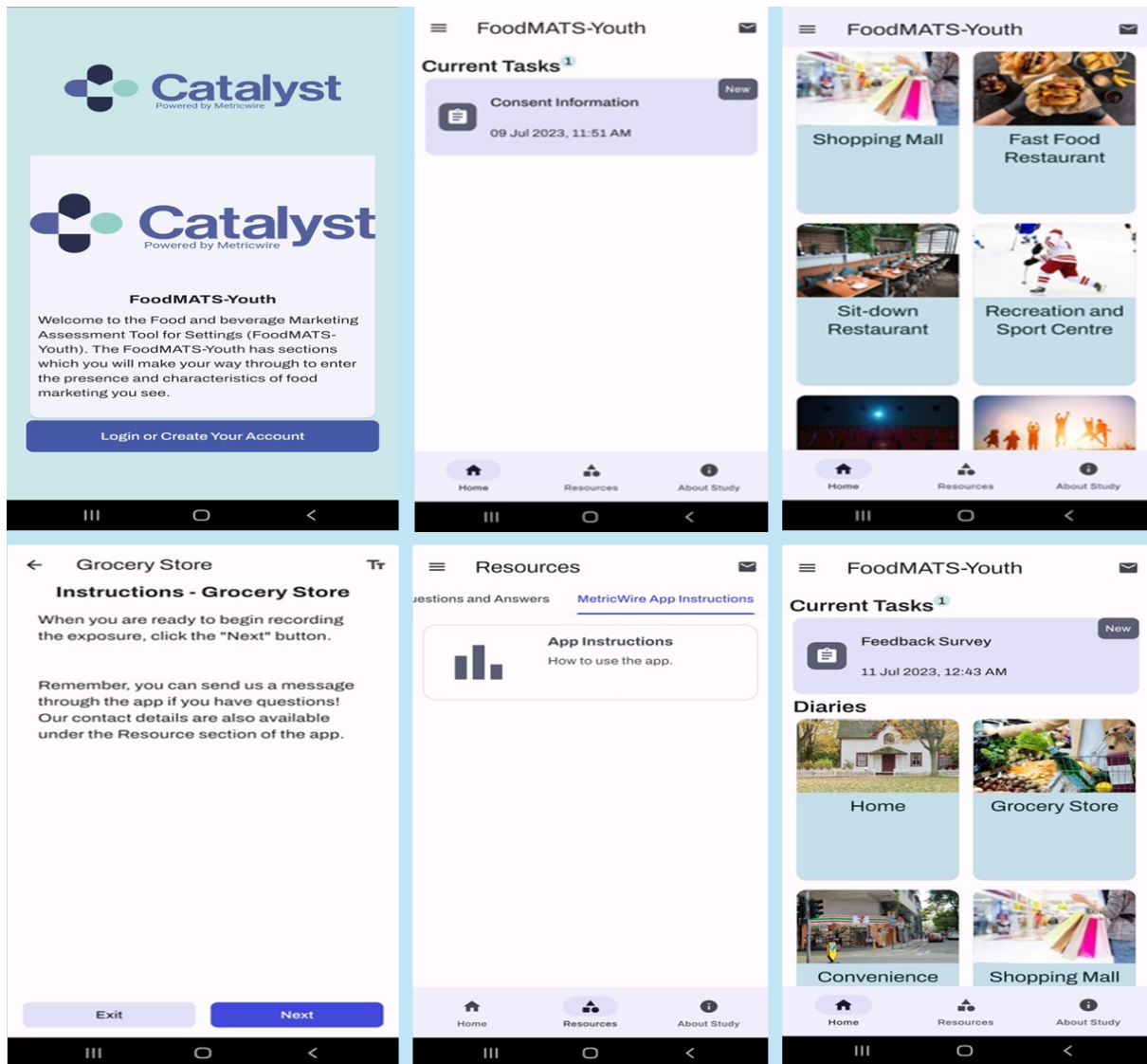


Figure 3.1 Screenshots of the FoodMATS-Youth

Pre-testing the Tool

The trial aimed to establish if the application was ready for use by our study participants and identify if there were aspects of the mobile application that needed to be clarified. I enrolled six young adults and got them to use the application to record food marketing instances they encountered over three days, mimicking what the actual study would look like. During the test, we noticed that the application responded slowly at times, and sometimes, a diary could just be stuck at "loading activity" without showing the questions in the diary. The rest of the diaries would respond normally, and just that one would not until the user logs out and in again. They also complained about receiving too many notifications because of how the notification triggers

were set up. Lastly, there were issues and confusion concerning where to record food marketing instances from social media.

We made numerous changes to solve all these issues and improve performance and utilization. First, a developer from MetricWire's team ran a couple of tests on the application and discovered that the reason behind the application responding slowly and some diaries being stuck was due to the size of the cover images putting undue strain on the application and the devices. We resized all the cover images, and this fixed the issues. I set the triggers to deliver push notifications five times daily, with at least 2 hours between each notification. I also added a new diary/location called "Social and digital media." After pretesting FoodMATS-Youth, we felt confident we could test the application to understand the feasibility, usability, and acceptability of a mobile application to measure exposure to food marketing by youth in NL in their daily life.

Data Collection Procedures

Participants were trained to use the mobile application to record food marketing instances they saw over three days. The training was conducted via a virtual meeting on Webex,[171] and it explained what the study was about, how to download the application and sign up, how to submit diary entries using it, how to access resources, and showed examples of food marketing. The training resources were also sent to each participant alongside the invite link. Every participant was required to attend a training session before they could use the mobile application. The diary submission by participants was used to create summaries of the techniques that commercial food marketers use to reach youth through multiple mediums and settings. The summaries were not used to measure food marketing exposure but to explore the power of food marketing. The photos submitted by the participants were used for photo elicitation to facilitate the focus groups and explore youth's experiences with food and beverage messaging and the feasibility of this method to examine their exposure to food

marketing across settings. The focus groups were conducted via Webex,[171] and the images were presented as a slideshow using PowerPoint.

Following the mobile usage period, participants participated in focus groups organized only by age to explore their experiences with food and beverage messaging in their daily lives and their experiences with the mobile application and data collection process. This helped gather information on youth perspectives on food messaging and marketing techniques, as well as the usability and acceptability of our mobile app. Eight focus groups were conducted and recorded via Webex,[171] a videoconferencing platform, to enable participants living outside of the city to participate. The focus group discussions were on topics that attempted to explore youths' opinions and beliefs—both individual and collective—on the food marketing they experience in their daily lives (focus group guide provided in appendix). It also addressed app-related questions, including the ease of use and navigation, functionality, willingness to use it again, and recommendations for additional features. The choice of focus group as a method is relevant to the study objectives. The feasibility portion of this study helped assess if an issue identified by one participant applies to others or if it was an isolated occurrence. It also helped explore how perspectives on food marketing are similar or different among youths and identify if there is a consensus among youth on what targets them or what does not. Utilizing photo elicitation in these focus groups was an integral part of achieving the second objective of this research. It helped get their reactions and comments on the photos they took and helped them elaborate on their experiences of food marketing, with the images serving as prompts and guiding the discussion.

3.4 Data Analysis

3.4.1 Feasibility of mobile application

This study provided data to test the feasibility of using the FoodMATS-Youth tool to collect data on food marketing to youth. Feasibility was assessed through app-derived

feasibility metrics, usability outcomes, and acceptability outcomes. These included response and completion rates, compliance rate, convenience, ease of use, etc. (see Table 3.2 for all outcomes assessed). Usability and acceptability were assessed using responses from the feedback survey and the responses to app-related questions in the focus groups.

The quantitative data from this study was analyzed using IBM Statistical Package for the Social Sciences V.29.[172] It was descriptive statistics that involved univariate analysis using frequency tables for the app-derived feasibility metrics, usability, and acceptability outcomes according to age. It also included a bivariate analysis using the Fisher's Exact Test to determine if there was an association between age group and rating category for the usability and acceptability outcomes. The qualitative data from this study was analyzed using Lumivero NVivo 14.[173] It involved transcribing the audio-recorded focus groups and de-identifying them. I then used thematic analysis to assess feedback on individual experiences while using the application to better understand usability and acceptability.[174] I assessed the mobile app-related outcomes by age group to see if those outcomes varied according to the age of participants.

3.4.2 Youth's perspectives and experiences of food and beverage messaging in their daily lives

The data for the second objective was analyzed using Lumivero NVivo 14.[173] The focus group was transcribed verbatim and then de-identified. The transcripts were divided into two sections: app-related responses and food messaging-related responses. Using transcribed participants' responses from the focus group, I conducted a thematic analysis to identify patterns and similarities in youth's experiences with and perspectives on food and beverage messaging.[174] To conduct the thematic analysis, I coded the responses, identifying areas of interest around food messaging.[174] These codes were data-driven and included all aspects of the data that related to food messaging. After coding and collating all the codes, I sorted them

into identified themes by combining related codes into an overarching theme. I created a thematic map showing themes, sub-themes, and related codes. The themes were then reviewed for internal homogeneity and external heterogeneity.[174] A content analysis of universal and setting-specific food marketing indicators was also carried out based on Health Canada's list of marketing indicators.[169] Two other raters (JS and LN) and I (IB) independently coded all the photos, and we, alongside a fourth trained rater (RP), discussed discrepancies in one-third of the codes. These discrepancies were resolved based on a consensus, and I (IB) confirmed the remaining codes based on the decisions from the discussion. The fourth trained rater (RP) and I (IB) resolved any outstanding issues that had not been previously discussed.

Provided below is a Table 3.2 showing the outcome concepts, outcomes, data source, and data analysis:

Table 3.2. Summary of outcomes of interest, data sources, and data analyses for this study

Outcome Concept	Outcomes	Data Source	Data Analysis
1. App-derived feasibility metrics	<ul style="list-style-type: none"> • Participant recruitment and retention • Response and completion rate • Response pattern • Compliance rate • Breadth of settings number of food marketing instances by settings/media • Quality of photos 	Back-end data of FoodMATS-Youth tool from Catalyst by MetricWire application	Descriptive statistics
2. Usability	<ul style="list-style-type: none"> • Ease of use • Navigation • Responsiveness • Ease of diary completion • Problems encountered on the application • Appropriateness of settings or locations on the app. 	Feedback survey and focus group	Descriptive statistics, Fisher's exact test and thematic analysis
3. Acceptability	<ul style="list-style-type: none"> • Willingness to use again • Perceived convenience • Experience using the application • Opinions on push notifications • Favorite parts of the application 	Feedback survey and focus group	Descriptive statistics, Fisher's exact test, and thematic analysis
4. Perspectives and experiences of food and beverage messaging	<ul style="list-style-type: none"> • Opinions on marketing techniques • Appeals of marketing techniques • Attitudes towards food messaging • Occurrence of messaging • Beliefs on the impact of food messaging 	Focus group	Thematic analysis of transcripts and content analysis of photos.

3.5 Rigor

To ensure rigor in this study, verification strategies were used to ensure consistency and suitability across all stages of the research process, from formulating the research question to data collection and analysis. Some verification strategies utilized include ensuring methodological coherence, memoing, sampling sufficiency, theoretical thinking, and concurrent data collection and analysis.[175–177] To ensure methodological coherence, our research objectives guided our design and method selection. These, in turn, informed our data collection process and the use of thematic analysis. This methodological coherence helped ensure that every step in the research process led to answering our research questions in the most efficient way possible.[175,177]

Memoing was carried out during and after data collection, and this helped document the ideas and themes that were showing up across focus groups.[176] Some of these ideas were then explored in more detail in subsequent focus groups. This also helped identify if the data being generated was answering the research objectives. We modified some questions after the first focus group to answer the research questions better. To achieve sampling sufficiency we recruited 24 youth across the province, similar to two other qualitative food marketing studies.[154,168] After completing three focus groups, we recognized the need to complete more focus groups to achieve our aim of data saturation as new information was still being generated. By the eighth focus group, there was no new information, and the study had reached data saturation.[175][178] Two similar studies exploring food marketing to adolescents in recreational settings had achieved data saturation with a similar sample size. One study had 11 participants,[154] and the other study had 24 participants but reached data saturation before they had analyzed all the transcripts.[168] We also examined negative cases that came up in the mobile application feasibility portion of the focus group and explored them to understand the deviation from already identified themes.[175] These negative cases were about difficulties

using the mobile application in one focus group, and they were further investigated in subsequent focus groups, but they were one-time isolated cases. We collected and analyzed data concurrently which helped identify emerging ideas and themes. It also helped explore those areas in more detail in other focus groups and identify more specific details on the areas being explored.[175,177] Theoretical mapping and thinking helped better understand youth experiences with cumulative marketing by exploring it in the focus groups, connecting it to other responses, and examining it in relation to current literature.[175]

3.6 Ethical Considerations

Ethics approval (File number: 20231737) has been obtained from the Health Research Ethics Authority (HREA) of NL. Participants were required to provide informed consent prior to the start of the study. Participants aged 13-14 provided youth assent and were required to provide parental consent. Participant confidentiality during the data collection process was ensured in multiple ways. The data captured using the Catalyst by MetricWire mobile application was synced to MetricWire's HIPAA-compliant servers immediately if the participant was connected to the internet. If the participant was not connected to the internet, the mobile application encrypted the responses and stored them until they could be synced to MetricWire servers. After all the data from this study is transferred to the research team, the data will be deleted from MetricWire's servers and stored on secured servers at Memorial University of Newfoundland.

There were no significant risks related to this study. However, some participants felt uncomfortable taking photos of ads they saw and they discussed it in the focus groups. To make participants comfortable in the focus groups, they were allowed to have their cameras on or off, depending on what was comfortable for them, and they were also informed that they could leave the focus group at any time if they no longer wished to participate. The researchers also asked participants to respect the privacy of fellow participants and treat all information shared

with the group as confidential. They were asked to refrain from repeating things said in the focus group outside the setting. Only the Principal Investigator and Supervisor had access to identifiable data. During data analysis, the data was de-identified and combined with other participants' data; therefore, participants could not be identified as no identifying information was retained. To ensure data security, identifiable data was accessed by only the Principal Investigator and his Supervisor on two password-protected computers. At the point of dissemination, there would be no identifying information in the data, as it had been de-identified during the data analysis process. Therefore, participant confidentiality was protected. Finally, after the completion of the study, a de-identified database will be archived and stored for five years on password-protected computers at Memorial University.

Co-authorship statement for Results Manuscript 1

This chapter has been prepared in its entirety by Idris Opeyemi Bamigbayan, as the primary contributor, with edits suggested by Dr. Rachel Prowse, Dr. Laurie Twells and Dr. Kirby Shannahan. The recruitment and mobile application training of participants was completed by Idris Opeyemi Bamigbayan. The focus group moderation was a joint effort between Idris Opeyemi Bamigbayan and Dr. Rachel Prowse. The data analysis was completed by Idris Opeyemi Bamigbayan, with guidance from Dr. Rachel Prowse. At the time of submission of this thesis, this manuscript has not been published. It will be prepared for submission to the Journal of Medical Internet Research.

Chapter 4: Results Manuscript 1

Manuscript Title: Exploring the Usability and Acceptability of the FoodMATS-Youth Application for Monitoring Food Marketing Exposures: A Feasibility Study.

4.1 Introduction

Unhealthy food and beverage marketing influences children's food preferences, attitudes and consumption[1] and children are exposed to marketing through many channels and settings including websites, apps, social media, school, stores, restaurants, video games and recreational settings.[34] This has led to the calls to prioritize protecting children from unhealthy food marketing.[20] Despite the evidence on the impacts of food marketing, comprehensive monitoring is needed to advocate for and sustain policies restricting food marketing to children.[65] Current monitoring approaches are likely to underestimate the level of exposure, and the focus on content analyses of TV advertising further worsens this.[66] Food marketing is ubiquitous, and there continues to be changes in how it is presented across settings and mediums. Methods to monitor food marketing need to adapt to this changing landscape.[179]

Crowdsourcing data from children and parents on their food marketing exposures is a relevant strategy for gathering data for monitoring efforts, and this can be done using custom mobile apps or websites.[66] With the exception of two studies that focused on teen-targeted food marketing exposures,[78,79] mobile applications have yet to be used to collect these data, despite the potential they have to be used for crowdsourcing relevant food marketing data.[78] Although mobile applications are increasingly being used in research, most studies that utilize them are intervention studies.[180] It has, however, also been successfully used as a data collection tool in diary studies where participants use their smartphones to submit photos and complete tasks, showing the versatility of apps in research.[148]

Smartphone ownership has increased significantly over the years, and the growing ownership has been observed in Canada, with 84% of Canadians owning a smartphone for personal use in 2020.[181] Statistics Canada also reported that 96% of Canadians aged 15-24 years used a smartphone in 2020.[182] This results in an increase in mobile application usage. The widespread usage of smartphones makes them an ideal tool for research and health interventions as they can be used to collect real-time data.[183] However, this could be undermined by limited access to smartphones among marginalized populations or a lack of proficiency in the use of mobile apps.[184] Teenagers use their phones daily and can thus be engaged in research that they find acceptable and in an environment they deem familiar.[185] In addition to being an efficient tool for data collection, mobile applications can also be used to engage with hard-to-reach populations.[186]

The development of mobile applications and other digital interventions requires feasibility testing[13], which determines if the application is appropriate for the objectives and its audience. Usability and acceptability are two of the most common outcomes often assessed in mobile application feasibility studies, as identified in the literature.[187–189] Usability refers to how much a product can be used to achieve its goals while maintaining user satisfaction efficiently.[190] Acceptability describes how much the users of an intervention consider it to be appropriate.[191] There is no consensus on the definition and conceptualization of these terms, and some argue that both terms overlap.[192–194] Some measures often evaluated under usability and acceptability include ease of use, responsiveness, navigation, satisfaction, recommendations, completion, convenience, efficiency, and attractiveness.[188,189,195]

This study explored the feasibility of using a mobile application to monitor food marketing exposures among youth (13-17 years). It focused on outcomes related to mobile

application usage, usability and acceptability, and the experiences of youth using the application.

4.2 Methods

4.2.1 Research Design

This was a convergent (QUAL+QUAN) mixed methods study.[149] This study tested the feasibility of a mobile application to assess food and beverage marketing exposures among youth using backend mobile application usage data, feedback surveys, and focus group discussions. The application usage data was used to assess application-based feasibility metrics, while the feedback surveys and focus groups were used to assess and understand the usability and acceptability of the mobile app. In this study, both quantitative and qualitative data were collected and analyzed concurrently, with no component informing the other.

4.2.2 Participant Sampling

This study was completed by twenty-three youth aged 13-17 years living in Newfoundland and Labrador. Participants were required to have access to a mobile phone for the study duration. Participants were recruited through Community Youth Networks (CYNs) and targeted social media ads (Facebook and Instagram). The CYNs are a provincial government-funded initiative providing community-based developmental programs for youth aged 12-18 years in NL. These networks contributed to participant recruitment by sharing the study information with their members. Facebook and Instagram ads were used to enroll older youth (15-17 years), as we were unable to sufficiently recruit that age group through the CYNs. Participants aged 13-14 provided parental consent and youth assent, while 15-17-year-olds provided their own consent. Recruitment was open to participants from all parts of the province as they were not required to travel for this study.

4.2.3 Ethics Statement

Ethics approval was obtained from the Health Research Ethics Authority (HREA) of Newfoundland and Labrador (20231737).

4.2.4 FoodMATS-Youth Research Tool

We collected data using our app, the Food and Beverage Marketing Assessment Tool for Settings and Youth (FoodMATS-Youth), which was created on the Catalyst by Metricwire application, a Canadian software application company with a record of facilitating digital health research. The FoodMATS-Youth had three main pages: Home, Resources, and Data Collection Diaries (Figure 4.1). It also had an About Study page, a consent information page at the beginning of the study and a feedback survey page at the end. The home menu contained diaries for 13 locations/settings, and each location had a cover image representative of it (Figure 4.1). The diaries contained instructions, an option to upload/take photos, and a series of questions on the marketing features of the ad in the photo. These questions were informed by Health Canada's list of food marketing indicators.[169] The mobile application included push notifications for reminders, and these notifications were delivered six random times per day, with a minimum interval of 2 hours apart and between 9 AM and 9 PM. The notifications read, "Where are you? Don't forget to take pictures of food ads you see!" The application also provides instant messaging for on-demand help from the research team if issues arise. The mobile application was developed to work on Android and IOS devices and offers real-time tracking of submissions and application usage.

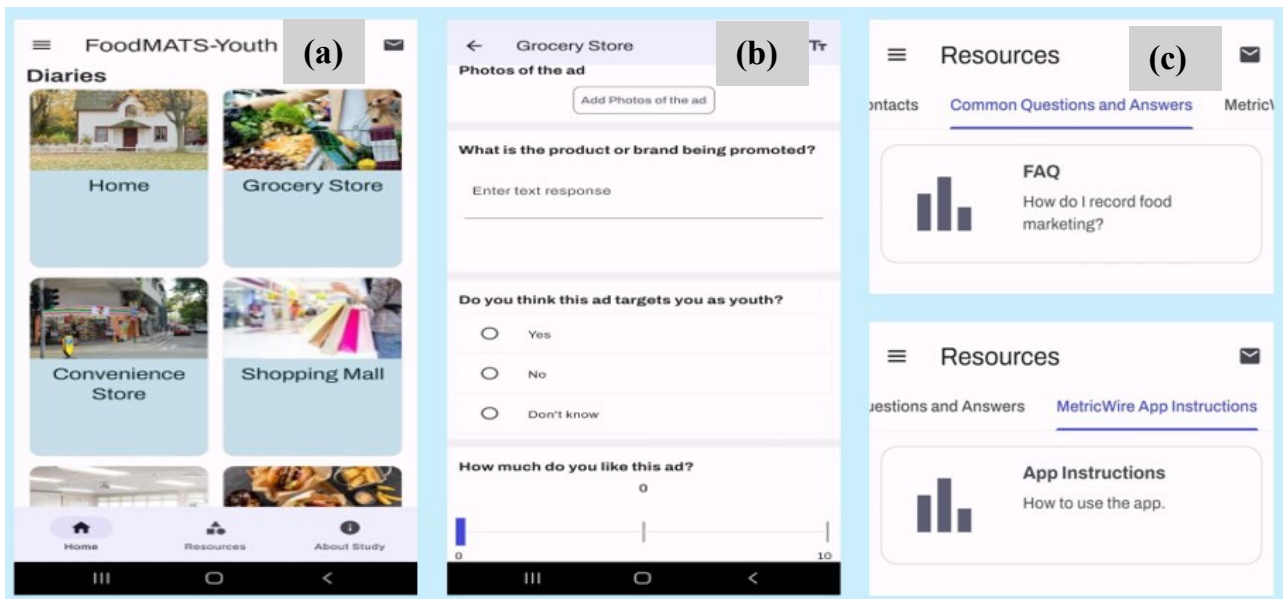


Figure 4.1 FoodMATS-Youth Mobile App showing the (a) Home, (b) Data Collection Diaries and (c) Resources

4.2.5 Data Collection

Consenting individuals provided demographics through a Qualtrics[196] survey, including names, phone numbers and emails of participants and parents, and information on income adequacy and access to a smartphone. Next, participants were trained on how to use the mobile application in a virtual training session via Webex.[171] Multiple training sessions were held based on participants' availability and preferences, and all participants were required to attend at least one training session. Participants were trained using a mobile application user guide detailing a step-by-step process of using the app. Training resources were sent to each participant alongside the application invite link after they had completed the training. They then downloaded the Catalyst by MetricWire application via their respective App Stores/Play Stores and used the FoodMATS-Youth tool. In the FoodMATS-Youth, they completed personalized diary entries each time they saw food marketing over 3 days (two weekdays and one weekend) by uploading photos of food marketing instances and answering a series of questions on the marketing features.

After the study period, they completed a feedback survey on the usability and acceptability of the app. This survey was used to assess the ease of use, convenience, responsiveness, and navigation of the mobile application, the effectiveness of the training resources, and their willingness to use the mobile application again. Participants were asked to rate each of these factors with a score between 1-5, with a score of 5 being the best.

Finally, all participants were invited to attend focus groups organized by age (13-14 years; 15-17 years) to explore their experiences with the app. The focus groups were conducted online via Webex,[171] a videoconferencing platform, as this enables ease of participation for participants living outside of the city. The focus groups were recorded on Webex[171] and transcribed verbatim afterward. The data collection period for this study was from June 2023 to April 2024.

4.2.6 Data Analysis

The quantitative and qualitative data from this study were analyzed using IBM Statistical Package for the Social Sciences V.29[172] and Lumivero NVivo 14,[173] respectively. Analyses compared feasibility outcomes by age group. Mobile application outcomes assessed included recruitment and retention rate, response rate, completion rate, response pattern, compliance rate, breadth of mediums, and quality of photos. Descriptive analyses were conducted, including measures of central tendencies (mean and median (IQR) for continuous variables. Cross-tabulations were conducted using Fisher's exact test for categorical variables due to small cell counts.

Specifically, frequency of photo submissions were calculated according to settings/mediums and analyzed the proportion of settings/mediums that had submissions according to age group. The mean rating for each feasibility outcome was calculated according to age group. The distribution of submissions overall and according to age group was also illustrated using a boxplot with the median and interquartile range. Cross-tabulations using

Fisher's exact test were calculated to assess whether the rating category for feasibility outcomes (ease, convenience, responsiveness, navigation, and willingness to use again) differed by age group. The rating categories used for the Fisher's exact test were Low (≤ 3) and High (4-5). I also conducted a thematic analysis[174] of focus group data to assess feedback on experiences while using the mobile application to understand usability and acceptability better. The focus group transcripts were coded inductively. After coding and collating all the codes, they were sorted into categories, which were then categorized into themes.

4.2.7 Rigor

Verification strategies were used in this study to ensure rigor consistency and suitability across the research process. To ensure methodological coherence, the objectives of this research guided the method for data collection and analysis. [175,177] Memoing of themes and ideas was carried out during and after data collection; this helped identify if the research objectives were being answered. [176] The negative cases identified were explored to assess the deviation from emerging themes.[175] Data collection and analyses were conducted concurrently to identify themes emerging from the focus group and explore them in other focus groups.

4.3 Results

4.3.1 Participant Characteristics

Twenty-three participants used our mobile application. Half (52.2%) of our participants were 13-14 years old. As regards to sex, a larger proportion (69.6%) of our study participants were females. There were participants from the metropolitan area and from rural parts of NL.

4.3.2 App-Derived Feasibility Metrics

Study recruitment and retention:

A total of 68 participants completed the consent form available through Qualtrics, and about two-fifths (39.7%) of these participants attended the mandatory training. Almost all

participants (95.7%) who used the mobile application also participated in a focus group (See Figure 4.2). Participants who dropped out at various stages of the study were either due to time constraints, travel plans or no communication.

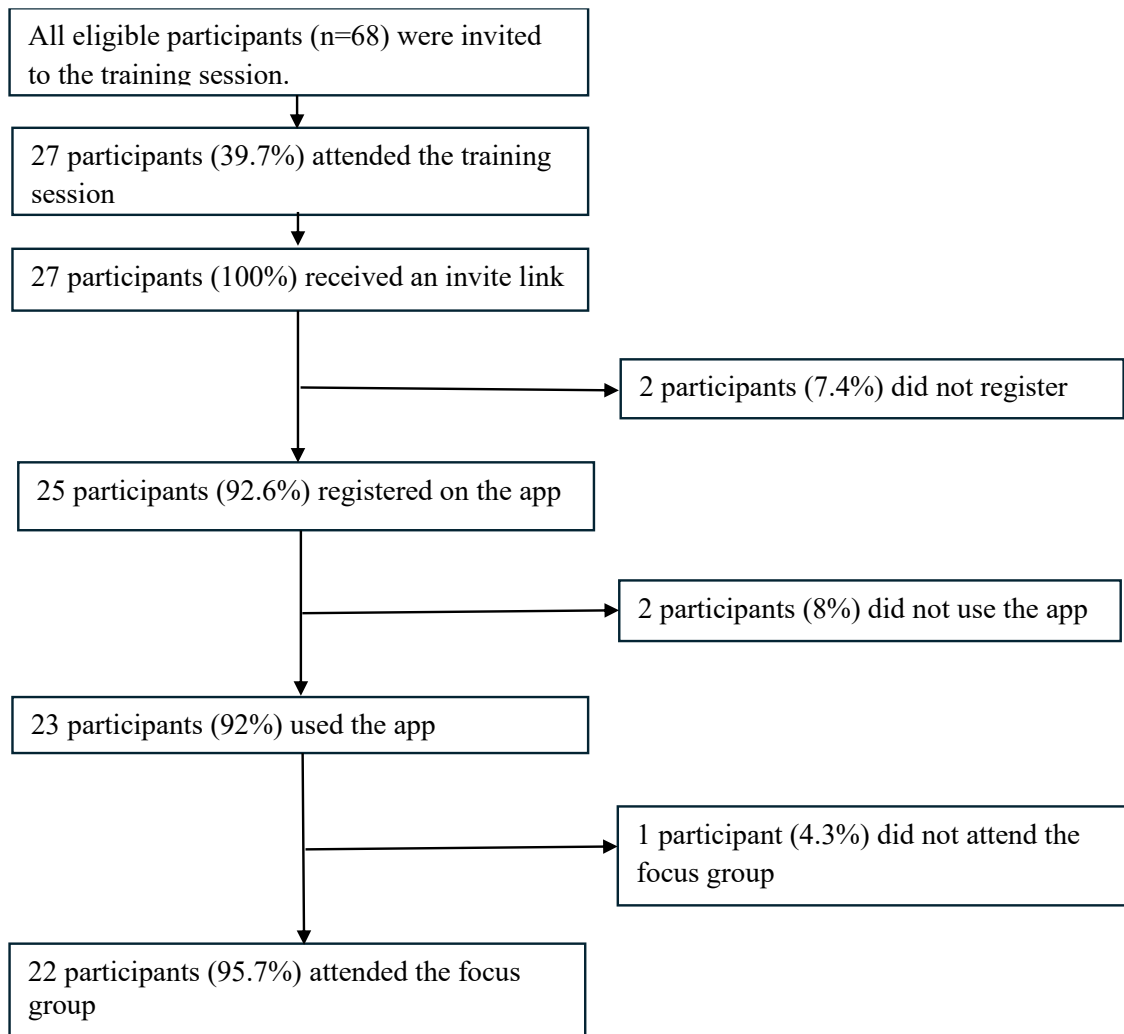


Figure 4.2. Flowchart showing recruitment and retention of study sample

Mobile application response and completion rate:

For response rate, most participants (85.2%) who received the application invite link downloaded the mobile application and used it. Almost all of the participants (92%) who registered on the application used it until the end of the study, resulting in a high completion rate.

Response pattern:

A total of 146 pictures were submitted, with some differences across age groups. This was an average of 6 pictures per participant, with a median of 4. The number of submissions ranged from 1 to 13 ads, apart from one participant who submitted 30 ads. There were 87 submissions from 13-14-year-olds and 59 submissions from 15-17-year-olds. The time of picture submission to the application varied across responses, with about half of the submissions being made from 7 PM to 10 PM. See Figures 4.3 and 4.4 for the distribution of submissions (x is the median).

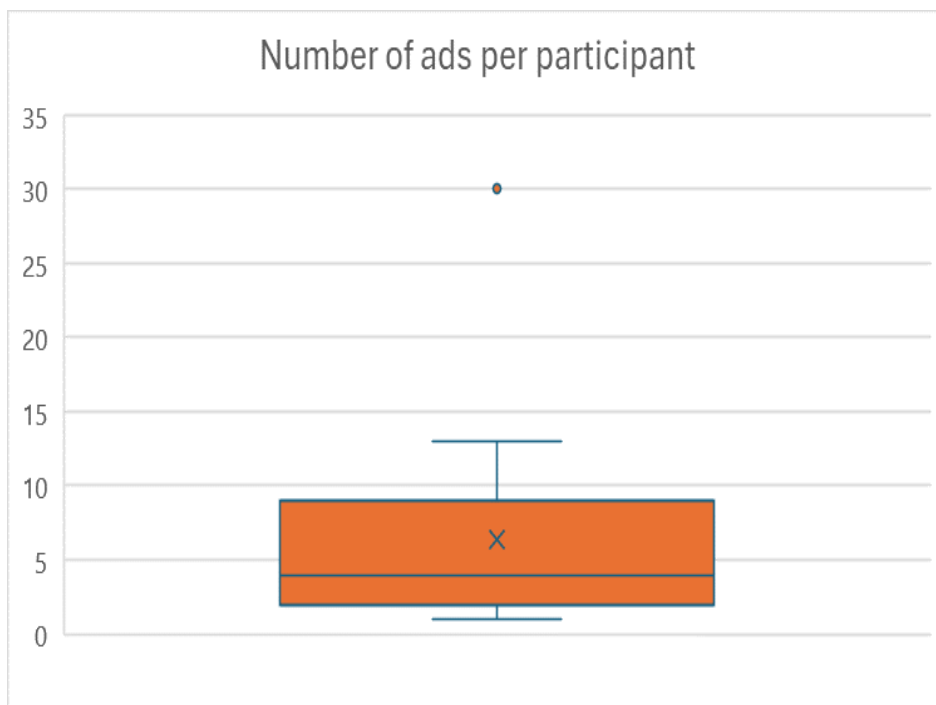


Figure 4.3. Distribution of total submissions

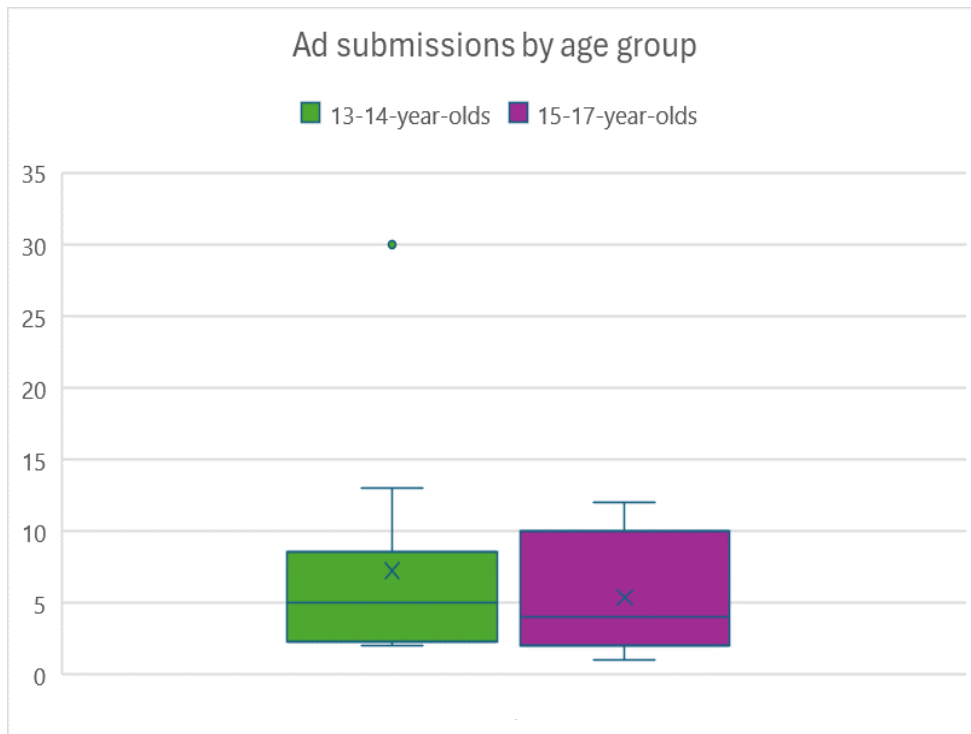


Figure 4.4. Distribution of submissions by age group

Compliance rate:

Most (92.0%) participants completed all tasks from application registration to feedback survey completion for this study. We define compliance as completing all mobile application tasks within the 7-day window. Of participants that used the application, most (n=18, 78.2%) completed all tasks on the mobile application within the defined study period. Five participants were non-compliant, completing the application portion of the study in an average of 12 days and a median of 12 (Range: 8 days after the compliance date)

Number of food marketing photos by settings/mediums:

The highest number of submissions were from social media, grocery stores, fast food restaurants, and shopping malls (See Table 4.1). Youth aged 13-14 years tended to have more submissions across a wider variety of settings. Social media recorded the highest number of submissions from both groups.

Table 4.1. Food marketing submissions by setting and age group.

Setting/Medium of FoodMATS-Youth Tool	Number of submissions (% of total)	Age group Submissions per age group	
		13-14 n (% of setting)	15-17 n (% of setting)
1. Home (TV, social media, flyer)	6 (4.1%)	3 (50%)	3 (50%)
2. Grocery Store	25 (17.1%)	18 (72%)	7 (28%)
3. Convenience Store	9 (6.2%)	3 (33.3%)	6 (66.7%)
4. Shopping Mall	10 (6.8%)	9 (90%)	1 (10%)
5. School	1 (0.7%)	0 (0%)	1 (100%)
6. Fast-food Restaurants	15 (10.3%)	8 (53.3%)	7 (46.7%)
7. Sit-down Restaurants	0	0	0
8. Youth Centre	0	0	0
9. Recreation and Sports Center	2 (1.4%)	2 (100%)	0 (0%)
10. Movie Theatre	1 (0.7 %)	0 (0%)	1 (100%)
11. Public Transportation	1 (0.7%)	1 (100%)	0 (0%)
12. Social Media	67 (45.9%)	36 (53.7%)	31 (46.3%)
13. Others ¹	9 (6.2%)	7 (77.8%)	2 (22.2%)
Total	146	87 (59.6%)	59 (40.4%)

¹Other locations in the submissions included gas station, bowling alley, roadside, hotel and craft fair.

Quality of photos:

The quality of the photos submitted was high, showing the product being advertised and the features of the ad clearly. This could be because participants made sure to take clear photos. However, some participants mentioned in the focus group that they did not upload unclear photos they took. The size of photos ranged from 31 kilobytes to 8.016 megabytes. The 15kb

was a picture of a billboard, most likely taken at a distance, and this was one of the poorest photos received. Although this photo was poor, most of the features in the advertising were still visible.

4.3.3 Feedback Survey Feasibility Metrics

Average score rating for each feasibility question: The average ratings for the feasibility questions ranged from 4.0 to 4.7, out of a possible average score rating of 5. The variable with the lowest overall rating and in both age groups was the ‘convenience’ of completing entries. The average rating for convenience was 4.0 (3.83 for 13-14-year-olds and 4.18 for 15-17-year-olds.) The average rating for each variable was slightly higher among 15-17-year-olds, except for the question on application responsiveness. The average rating on this question was 4.58 for 13-14-year-olds and 4.36 for 15-17-year-olds (See Table 4.2 below)

Table 4.2. Mean ratings for feasibility questions and frequency of each rating according to age group

Usability and Acceptability Question ¹	Average rating ²	Age Group (years)	Average rating per age group	Ratings			
				2 (n)	3 (n)	4 (n)	5 (n)
How easy was it to use the app?	4.48	13-14	4.33	1	1	3	7
		15-17	4.64	0	0	4	7
How helpful was the training resource provided on using the app?	4.61	13-14	4.58	0	0	5	7
		15-17	4.64	0	0	4	7
How convenient was completing mobile diary entries?	4.0	13-14	3.83	2	2	4	4
		15-17	4.18	1	1	4	5
How responsive was the app?	4.48	13-14	4.58	0	1	3	8
		15-17	4.36	1	0	4	6
As it relates to navigation, how easy was it to move in and out of the app?	4.70	13-14	4.67	0	0	4	8
		15-17	4.73	0	1	1	9
How willing are you to use this app again?	4.26	13-14	4.0	2	1	4	5
		15-17	4.55	0	2	1	8
Total score (out of 30)³	26.53	13-14	25.99				
		15-17	27.1				

¹Rating for each feasibility question ranged from 1-5. There was no rating of 1 from participants on any of the questions.

²Total possible rating for each question is 5.0

³This was calculated by adding up the total possible rating for all feasibility questions.

Association between age group and rating category:

There was no significant association between proportion of individuals by age group that ranked each feasibility variables as high or low (two-tailed $p > 0.05$) (see Table 4.3).

Table 4.3. Association between age group and rating category

Feasibility Variables ¹	Rating Category	Age Group		P value (Fisher's Exact Test) ²
		13-14 n (%)	15-17 n (%)	
Ease	Low (<3)	2 (16.7%)	0 (0%)	p=0.478
	High (4-5)	10 (83.3%)	11 (100%)	
Convenience	Low (<3)	4 (33.3%)	2 (18.2%)	p=0.640
	High (4-5)	8 (66.7%)	9 (81.8%)	
Responsiveness	Low (<3)	1 (8.3%)	1 (9.1%)	p=1.000
	High (4-5)	11 (91.7%)	10 (90.9%)	
Navigation	Low (<3)	0 (0%)	1 (9.1%)	p=0.478
	High (4-5)	12 (100%)	10 (90.9%)	
Willingness to use it again	Low (<3)	3 (25%)	2 (18.2%)	p=1.000
	High (4-5)	9 (75%)	9 (81.8%)	

¹The usefulness of training resources could not be computed as all participants rated it high.

²Fisher's exact test was used due to the small sample size.

User language:

Almost all participants agreed the language in the mobile application was clear (95.7%).

Type of device:

About two-thirds of participants used an iOS device (65.2%), and the rest used an Android device (iOS=15 and Android=8).

4.3.4 Feasibility based on Focus group themes

Theme 1: Mobile application interface and functionality: Influence on ease of use

Overall, most participants found the application easy to use. This description of the application was often associated with how the design of the application was user-friendly, simple, and streamlined. Most participants described this as their first opinion of the mobile application

when they started to use it, and it was also commonly mentioned as what they loved most about the mobile application. This opinion remained the same throughout the study period, as participants continued to find it easy to use the application from the start to the end of the study.

One participant said: “I thought that the app’s simplistic design was really helpful and it made it so that understanding what to do was really easy. So, I didn't have any problems with using the application. It was really like just straightforward. I enjoyed that” (Participant 8, 14 years).

Participants also thought the mobile application made the process of submitting photos brief and efficient. It was quick and easy for participants to find their way through the application when they needed to upload photos and complete the diary entries.

Another participant said: “I found it very straightforward to use. Once I opened the app, every, I guess, location that I could have found ads in was there, and all I had to do was click it. And the questions were also very straightforward, and I felt the questions were about the point right away. So it was very easy to put in my information and then click submit with and without internet.” (Participant 21, 16 years).

Some participants, however, experienced some problems when using the mobile app. They experienced lagging at the point of submission and were sometimes unsure if the submission had gone through. The mobile application did not have a repository where participants could view their previous submissions, so this further influenced the doubt of whether submissions had gone through. There were also a few occurrences where participants completed a submission, but their photos were not attached.

One participant recalled: “It was mostly just after I submitted my answers, it would take a good few seconds to load back into the homepage. So I was afraid if I closed it too fast, it wouldn't save.” (Participant 22, 15 years).

Theme 2: Mobile application features: Influence on user satisfaction

Users reported different reactions to the features of the mobile app. There was no consensus on the questions in the diaries. Some participants thought the questions were relevant and the right number, as they helped describe the advertisement without the need to put in too much information. However, some participants felt completing the questions for every submission was time-consuming. These participants preferred fewer questions or an option only to answer questions on their favorite ads. Concerning the settings on the app, participants loved that the application contained most of the locations they visited often, and this made it evident that it was targeted toward their age group. This also came out as one of their favorite things about the app. The only other location that participants want to be added was the 'roadside'.

One participant said: "Personally, for me, I just like how many options there were. Like, there were a lot of common categories that I go to often, and I also really like there was like an option called others, so you could select that, so it's not like, you know, "I took this photo, and this category isn't there, so I guess it's not good." So I like that that category was included." (Participant 9, 13 years).

The cover photos for each setting also particularly drew attention. Participants felt that they were perfectly fitting in the locations they represented. The cover photos made the home page visually appealing, and they thought the diaries themselves needed to be more fun and colourful to fit with the homepage.

One participant said: "I thought the photos on the front page that went with the other location categories were really, I want to say, like, they were really attractive, like, they did draw my attention." (Participant 21, 16 years).

There was some divide between opinions on the application's push notifications. All participants found the notifications to be helpful reminders, but some of them found it

annoying, too. Some participants recalled that they came in too often and felt they no longer needed that many notifications once they got into the habit of uploading pictures. One participant also mentioned how it would be better for the notifications to say different things.

She said: “You know, to be very honest, they're kind of repetitive. You know, they keep saying the same thing over and over, and that's the thing I don't like about apps. Notifications, I mean, sorry...See, it just told me one “where are you” and that's the same one as before. Like say, for example, number two will be like. “Did you forget to take a picture? Take your picture now,” or another one can be like, “Oh, are you are you eating at a restaurant?” or something like that...” (Participant 20, 16 years).

Theme 3: Practicality and integration into daily life: Reflecting on participant experiences

Most participants mentioned that the application was minimally disruptive to their daily lives, and they did not find it burdensome. This was sometimes a result of being on break from school or living in small communities with minimal advertising. The simplicity of the process was also a factor.

One participant said: “It wasn't really that difficult. It only takes, like, thirty seconds to take a picture and send it, so it's not all that hard.” (Participant 10, 13 years).

Another recalled: “It was a pretty simple process, so it didn't really interfere with anything, and I was also on Easter break so that also made it easier.” (Participant 15, 17 years).

When asked if they made diary entries on the spot when they saw ads, some participants said they did not. They found it more convenient to complete the mobile diaries at home or upload all pictures at the end of the day. A participant said she had fixed goals when shopping and did not pay attention to advertising outside. There were also mixed reactions to taking photos in

public as some participants felt confident and had no problems taking pictures, while others felt nervous. This was not age-specific. Overall, most participants uploaded screenshots from digital media immediately and other pictures at home.

One participant recalled: “Well when I was at home, and I was taking screenshots and everything, I would just send them in right away. But when I was out, and I took a few pictures, I was with friends and stuff. So I kind of just snapped the picture, put my phone away, and was like, I’ll do that when I get home. And that’s what I did.” (Participant 17, 17 years).

4.4 Discussion

This study aimed to develop and test the feasibility of the FoodMATS-Youth application as a tool to crowdsource food marketing exposure data from youth. The results from the feedback survey and focus groups demonstrate the FoodMATS-Youth had high usability and acceptability, making it a feasible application to capture food marketing messages among youth. This was supported by the high response, completion, and compliance rates. Overall, participants were satisfied with the ease of use, navigation, aesthetics, responsiveness, and appropriateness of the mobile application, and this did not differ by age group. However, there were also challenges faced by participants while trying to make submissions through the application and recommendations by the participants on how to improve it.

Most feasibility outcomes being measured were rated high by participants, indicating excellent usability and acceptability of the mobile application. This is comparable to findings from another study, which evaluated application usability in terms of ease of use, willingness to use again, and clarity. [197] Mobile application usability often depends on the interface design, which influences ease of use and user-friendliness.[198] This explains why users frequently reported that our mobile application’s simplistic and efficient design was one of the reasons it was easy to use. Previous researchers have reported adolescents are interested in apps

based on their appearance and how they feel, especially if they are aesthetically pleasing and simple to use.[199] The acceptability of the mobile application was generally high, as participants had positive experiences using it and were willing to use it again. They also believed the application was designed for their age group based on the diaries.

The convenience of diary completion was satisfactory overall. However, it had the lowest mean score of all acceptability outcomes measured. Participants stated they had no problems incorporating the application into their daily routine; however, most participants did not complete the diary submissions immediately after taking the pictures. This was not a problem when they submitted photos, as they could refer to the photos to respond to questions about the product being advertised, the setting, and the marketing features present in the advertisement. However, not submitting them immediately meant participants occasionally forgot to upload some photos. Convenience is an important factor for mobile application users, and they prefer data collection tools that require minimal effort. If participants need to complete manual entries, like in the case of our app, it should be as convenient as possible. Lack of convenience would limit participant engagement.[200]

A large portion of the photos submitted were from social media. Many reasons could influence this, including the possibility participants did not visit as many physical settings during the three days of data collection or were preoccupied with other activities when in those settings. Some study participants reported they drove by billboards and did not get an opportunity to take good photos. Looking at findings from the literature, food marketing is significantly moving into the digital space[25,26], which could explain the volume of ads from social media. Considering the level of food marketing exposure through social media and the influence it has, it is important to focus food marketing monitoring efforts on this medium.[201]

The mobile application completion rate was very high at 92%. Most of the participants who registered on the application completed the study. This was higher than other feasibility studies testing mobile applications among youth which had overall completion rates of 33% and 68%.[202,203] However, these studies were interventions and often required a longer application usage period. Most of the participants who attended our training session used the application till the end, and they found the training session very useful as it had one of the highest ratings on the feedback survey. A similar mobile diary study mentioned that they set up meetings with participants for an application demonstration before starting the study to increase participant retention.[148] This could explain our high response and completion rates, as participants already understood how the application worked and had resources to consult when necessary.

The push notifications/notifications garnered mixed reactions from our participants, and this finding is similar to another study, which found a divide among participants on receiving notifications in general.[30] Another study that used a similar number of notifications daily also reported that participants complained of the notifications being too much, repetitive, and random.[204] This suggests that fewer notifications might be more acceptable. It could also be relevant to consider event-based notifications where the application detects movement using mobile sensors and sends notifications to participants when they leave home.[205] This has to be adequately considered, as participants can feel monitored when they receive notifications.[204] Notifications are essential as they help remind participants to take photos and could be sent individually to participants who need them more.[148] Notifications on the FoodMATS-youth may also be important in reducing potential underestimation of food marketing exposures. Still, it is crucial to keep them as less disruptive as possible.[206]

Overall, participants said they enjoyed the mobile application and gave recommendations to improve the experience. Some of the recommendations from the focus

group included building transitions or animations to the diaries so the aesthetics can match the home page and make it more visually appealing. Another was alternating the content of the push notifications so it does not seem redundant. Also, participants suggested a repository where they can see past submissions, which would be helpful. These are recommendations to be considered in future updates for this mobile application and future app-based studies.

4.5 Strengths and Limitations

This was a mixed methods study which quantitatively assessed the feasibility of the mobile application while exploring youth's perspectives and experiences with the rigor of qualitative research. This study led to the development of a digital app-based data collection tool that can be used to collect data on food marketing to youth. This tool can include hard-to-reach populations in future studies on food marketing to youth in NL and beyond. This study also adds to the limited literature on the feasibility of mobile apps as data collection tools. The sample size in this study was small, which limited the ability to detect if there was a significant difference in feasibility outcomes between age groups. Also, participants were only required to take pictures for three days, and participants whose 3-day study data collection fell on holidays found the use of the mobile application to be a lot less disruptive to daily life. Some additional measures may be needed to support participant engagement over a longer data collection period. Future research also needs to evaluate how the period of data collection (school day, weekend, holidays, etc.) impacts the extent of marketing that participants are exposed to and that they record. Some participants did not upload all the pictures of marketing that they took as they did not always upload the pictures immediately. This likely underestimates the amount of marketing they are exposed to, but it shows those that are potentially more important to youth. It might also result in a bias based on the settings and media, that participants find easier to take pictures in and upload.

4.6 Conclusion

The FoodMATS-Youth application had high usability and acceptability among 13 to 17-year-olds to capture food and beverage marketing instances. Participants found it easy to use and experienced little to no issues with its functionality. The results from this study demonstrate the mobile application's utility in assessing food marketing instances across settings and show its potential to contribute to food marketing monitoring efforts in Canada. This research needs to be replicated in a larger sample to ascertain that it can be successfully used for large-scale monitoring of food and beverage marketing exposures.

Co-authorship Statement for Results Manuscript 2

This chapter has been prepared in its entirety by Idris Opeyemi Bamigbayan, as the primary contributor, with edits suggested by Dr. Rachel Prowse. The recruitment and mobile application training of participants was completed by Idris Opeyemi Bamigbayan. The focus group moderation was a joint effort between Idris Opeyemi Bamigbayan and Dr. Rachel Prowse. The thematic analysis was completed by Idris Opeyemi Bamigbayan, with guidance from Dr. Rachel Prowse. The photo content analysis was completed by Idris Opeyemi Bamigbayan, with photo coding contributions from Dr. Rachel Prowse, Jillian Skiffington and Nan Lei. At the time of submission of this thesis, this manuscript has not been published. It will be prepared for submission to the Journal of Adolescent Health.

Chapter 5: Results Manuscript 2

Manuscript Title: Exploring Exposure to Unhealthy Food and Beverage Messaging to Children across Settings. A Snapshot from Newfoundland and Labrador.

5.1 Introduction

Eating habits are developed early in life, and they can influence the health of people in adulthood.[207] Canadian children have poor food consumption patterns as they have low fruit and vegetable intake and an increasing consumption of packaged foods and beverages high in sugar, salt, and fat.[208] These eating habits result in poor health outcomes and influence the occurrence of overweight, obesity, and numerous non-communicable diseases.[209] The food environment shapes eating habits, and food marketing plays a role in this through its influence on children's food preferences and consumption.[2] The Hierarchy of Food Promotion Effects model explains the link between food messages through advertising and promotions, children's diets, and its effect on children's weight outcomes.[99] Specifically, exposure to promotion increases children's brand awareness by increasing brand recall and recognition. Children then develop positive attitudes and preferences for the brand and promoted products. These attitudes and preferences could be shaped through cumulative exposure, the presence of characters, premium offers, and other techniques. These then influence the purchase intent of the child or parents, the actual purchase, and ultimately, the consumption of the promoted food.[99]

Exposure to food messages is ubiquitous[94] as it is present across multiple settings, including children's everyday settings.[72] However, the impact of food marketing is not only dependent on the exposure to messages but also the 'power' of the message.[62] 'Power' refers to the creative content and design of the marketing message, as well as the techniques used to deliver it to the target audience.[62] The food and beverage industry uses numerous techniques to promote unhealthy food products to children. These include cartoon characters, appeals to fun, unusual product flavours, and bright colours. These, among other techniques, represent

the power of food marketing and aim to persuade children and their parents.[210] Power has an influence on the types and amounts of food messages that children notice and remember,[211] and persuasive techniques are often used to promote unhealthy food products.[72]

Despite the recent increase in the number of studies exploring food marketing to youth, these studies have only looked at marketing in specific settings.[78] Thus, there has been limited research on the persuasive techniques that youth are exposed to daily.[78] A couple of studies have explored the power of food marketing on television,[212] packaging,[57] and digital media[213] However, to date, only two studies in Canada[78,79] have explored the power of food and beverage messages that youth are exposed to across settings and media using a mobile app called “GrabFM!”. These studies only explored food marketing that targeted teens, using the app, potentially underestimating the power of marketing instances that participants notice and are influenced by but are not perceived or classified as teen-targeted. As a result of this research gap, my study focused on understanding the power of food messages to youth (13-17 years) in NL by exploring participants' experiences and perspectives on the food and beverage messaging they see daily and assessing the techniques present in marketing photos they recorded.

5.2 Methods

5.2.1 Research Design

This was a convergent (QUAL+QUAN) mixed methods study.[149] This study captured youth’s exposure to food and beverage messaging in their daily lives, using a digital application (FoodMATS-Youth) to record photos of food marketing noticed by youth over three days. Using photo-elicitation in focus groups and content analysis, we assessed the marketing techniques that participants were exposed to, explored how these techniques appealed to them, and identified the presence of food marketing indicators in the photos submitted.

5.2.2 Participant Sampling

Individuals eligible to participate in our study had to be between the ages of 13-17, living in Newfoundland and Labrador, and have access to a smartphone for the study duration. The participants for this study were twenty-three youth aged 13-17 years living in Newfoundland and Labrador (NL). Participants were initially recruited through Community Youth Networks (CYNs), an initiative funded by the Government of NL that aims to provide developmental programs and services for youth aged 12 to 18 years across the province. These networks shared our study information with members through their various communication channels. The initial recruitment strategy attracted mainly youth aged 13-14 years; we launched targeted social media ads on Facebook and Instagram to recruit sufficient numbers of 15-17-year-olds. Younger participants aged 13-14 years provided parental consent and youth assent for this study, while older participants aged 15-17 years were allowed to provide their own consent. Participants were also offered \$30 e-gift cards as a token of appreciation for participating in this study.

5.2.3 Ethics Statement

Ethics approval was obtained from the Health Research Ethics Authority (HREA) of NL (20231737).

5.2.4 Data Collection

Information like income adequacy, access to a smartphone, names, emails, and phone numbers of participants and parents, was collected using a demographic survey, completed when providing study consent. Consenting participants attended a virtual training on collecting data using our app, the Food and Beverage Marketing Assessment Tool for Settings and Youth (FoodMATS-Youth). They were then sent training guides developed by the researcher and an application invite link. Participants downloaded the Catalyst by MetricWire platform through the App Store for Apple devices and Play Store for IOS devices. The FoodMATS-Youth app is hosted on this platform. Participants used it to record photos of food marketing instances they

came across over three days (two weekdays and one weekend). Each participant was invited to attend one focus group organized by age (13-14 years; 15-17 years) to explore their perspectives and experiences with food and beverage messaging. Photo elicitation was used in the focus groups with a PowerPoint slideshow of marketing instances submitted by the participants. The focus groups were conducted online via Webex[171] and lasted an average of one hour. They were recorded on Webex[171] and transcribed verbatim afterward. The data for this study was collected between June 2023 and April 2024.

5.2.5 Data Analysis

The focus group data from this study was analyzed using Lumivero NVivo 14,[173] using thematic analysis to identify and analyze themes around participants' perspectives and experiences with food messaging.[174] The focus group data was collected and analyzed concurrently to identify themes and explore them in more detail in the focus groups.[175,176] I also conducted memoing to document the themes and ideas that came out of the focus groups. The focus group transcripts were coded inductively, allowing the codes to emerge from our data. After coding and collating all the codes, they were sorted into categories, which were then categorized into themes. The themes were reviewed for internal homogeneity and external heterogeneity,[174] and inconsistent codes and similar themes were recategorized to support data quality and rigor. Codes, categories and themes were also analyzed between age groups to identify if there were age differences.

A content analysis of marketing indicators independently by three raters, according to Health Canada's list of marketing indicators.[169] These indicators were developed based on expert advice, existing protocols, scientific literature, and policy considerations.[169] There were 22 universal indicators (e.g., branded characters, games or activities, appeals to health or nutrition) to be assessed in marketing in all media and settings, and there were 18 setting-specific indicators for product packaging, television, digital media, food retail, restaurant, and

community settings (see appendix for indicators and descriptions.) Only screenshots of videos were coded, as this is what participants submitted, therefore, some specific indicators for digital media (child songs or music and special effects) were unable to be coded.

The setting where each picture was taken was determined based on the FoodMATS-Youth diary into which the participants uploaded the photo (e.g., grocery store, recreation and sports center, social, digital media). Three raters (IB, JS, and LN) coded all marketing photos and identified the presence or absence of the marketing indicators. Each marketing feature in the advertisement was assigned to a single indicator to avoid double coding.[169] Discrepancies for one-third of photos were discussed amongst all raters with a fourth trained rater (RP) where any inconsistencies in the coding were resolved based on a consensus. Based on the decisions from the discussion, the remaining codes were confirmed by a single rater (IB), and any outstanding issues not previously discussed were resolved by the rater (IB) and the fourth rater (RP).

The content analysis and focus group results were compared to determine if they supported or contradicted each other. By completing both analyses, I was able to assess if frequently occurring indicators were related to what our participants interacted with and were influenced by daily and identify if there were techniques that impacted them but were missing or underrepresented in the content analysis.

5.3 Results

5.3.1 Participant Characteristics

Twenty-three participants used the FoodMATS-Youth to submit photos of food marketing. Half (52.2%) were 13-14 years old. A large proportion (69.6%) of our participants were females. On perceived income adequacy, a large proportion (73.9%) of participants reported that their family has enough money for things the family needs. There were participants from the metropolitan area and from rural parts of NL.

5.3.2 Marketing instances submitted

A total of 146 photos were submitted by our participants, of which five were excluded during content analysis as they were not considered marketing instances. The excluded photos did not advertise any product or brand. About half (48.9%) of the photos submitted were from digital media, mainly consisting of social media advertisements on TikTok, Snapchat, Instagram, and Facebook. Figure 5.1 shows some examples of the photos submitted from digital media, grocery stores, sports and recreation centers, and outdoors.

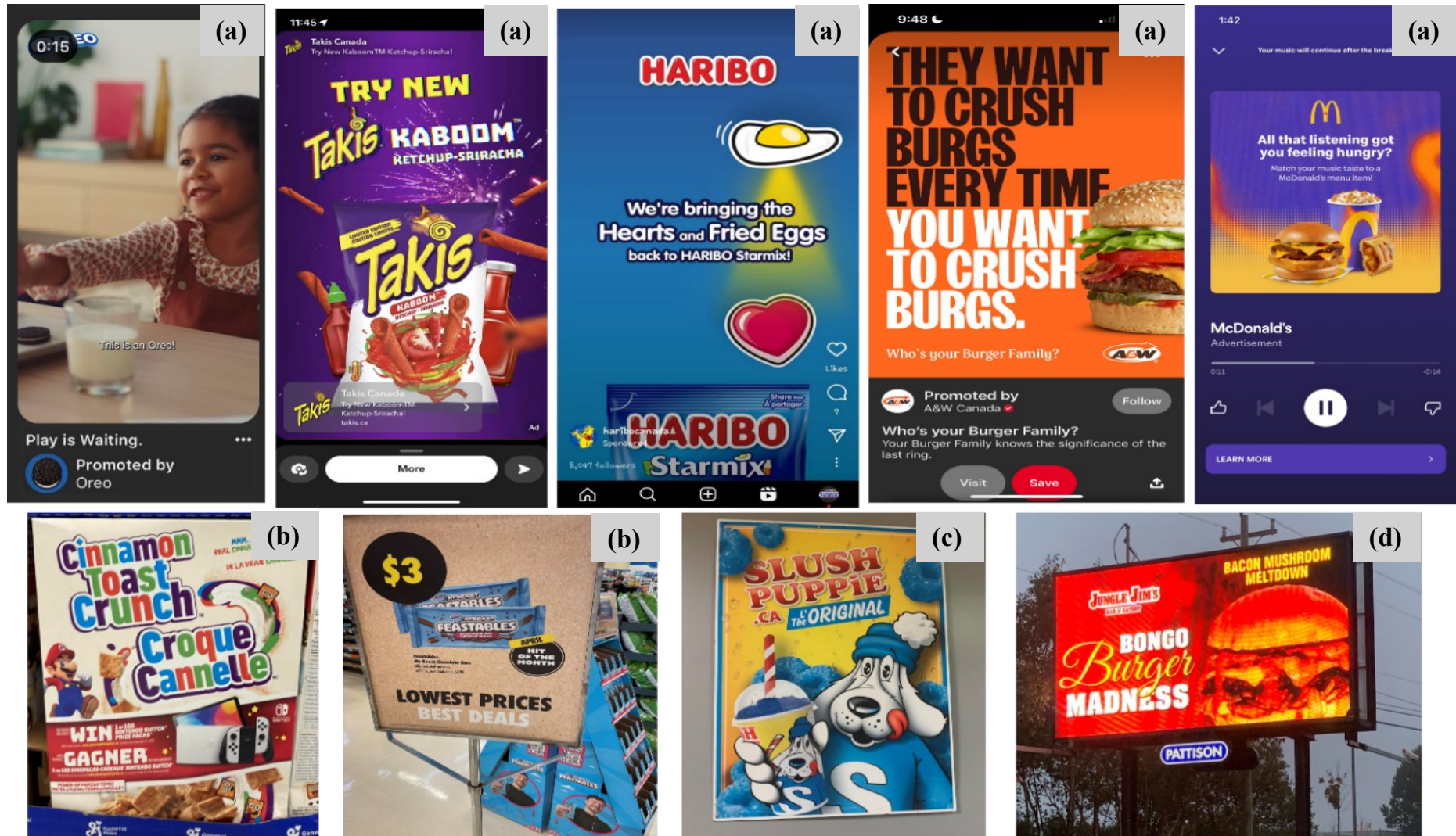


Figure 5.1. Examples of marketing instances submitted from (a) digital media, (b) grocery stores, (c) sports and recreation centers, and (d) outdoors

5.3.3 Content analysis of marketing instances submitted by participants

One-third (34.0%) of the photos submitted by participants contained price promotions, incentives, or giveaways, which was the most frequent marketing indicator observed (Table 5.1). This was followed closely by calls-to-action (32.6%) (see Figure 5.2 for examples of instances with the top two marketing indicators). Commercial-branded infrastructure, displays, furniture was the most frequent observed for setting-specific indicators (present in 83.3% of all community setting marketing instances). Product packaging (66.7%) and island displays (41.7%) were also common setting-specific indicators. Indicators like the presence of children, the presence of teens, and adult-teen situations were uncommon; characters (especially branded) were much more common (21.3%). Unusual product appearance or flavour accounted for 14.2% of the indicators present (see Table 5.1).

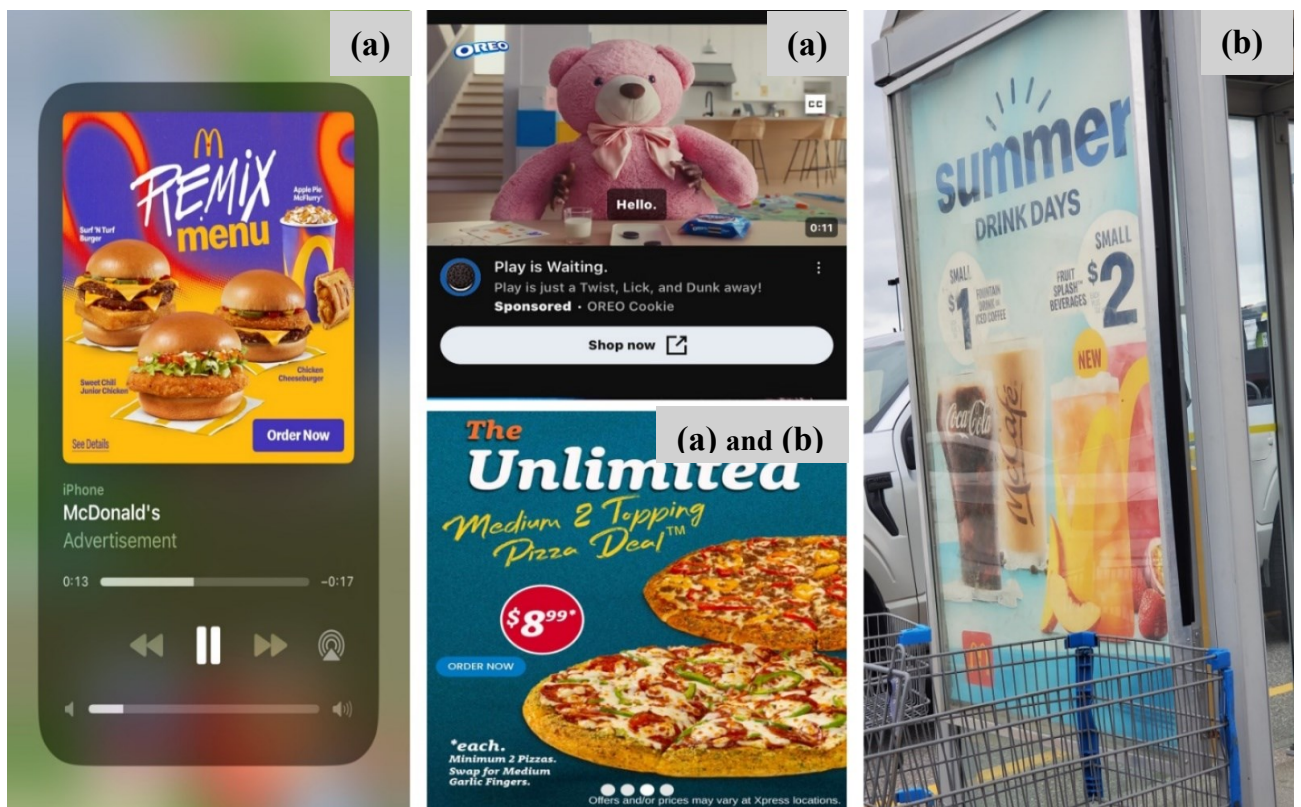


Figure 5.2 Examples of marketing instances with (a) calls-to-action and (b) price promotions, incentives, or giveaways

Table 5.1 Content analysis of marketing instances

Marketing Indicator		Frequency (n=141)
Price promotions, incentives, giveaways		48 (34.0%)
Calls-to-action		46 (32.6%)
Appeals to fun/cool		26 (18.4%)
Child themes or visual design		22 (15.6%)
Branded Characters		21 (14.9%)
Use of teen language		11 (7.8%)
Unusual product flavour		11 (7.8%)
Appeals to health or nutrition		10 (7.1%)
Celebrities or public figures		9 (6.4%)
Unusual product appearance		9 (6.4%)
Use of child language		8 (5.7%)
Teen themes or visual design		8 (5.7%)
Other cartoon characters		5 (3.5%)
Licensed Characters		4 (2.8%)
Promotion of product convenience		4 (2.8%)
Games or activities		3 (2.1%)
Cross-promotions		3 (2.1%)
Presence of children		2 (1.4%)
Displays of social responsibility		2 (1.4%)
Presence of teens		1 (0.7%)
Adult-teen situations		1 (0.7%)
Adult-child situations		0 (0%)
Setting-specific indicators		Frequency
Community Settings (n=18)	Commercial-branded infrastructure, displays, furniture	15 (83.3%)
	Commercial-branded clothing, objects, equipment	1 (5.5%)
Food Retail Settings (n=24)	Island display	10 (41.7%)
	Endcap display	3 (12.5%)

	Check out display	2 (8.3%)
Product Packaging (n=15)	Other appeals to nutrition or health	10 (66.7%)
	Government-regulated health or nutrition claim/symbol	3 (20%)
Restaurant Settings (n=6)	Seasonal or limited-time menus	2 (33.3%)
	Children's menu	1 (16.7%)
	Children's activity	0 (0%)
	Value menu	0 (0%)
Digital Media (n=69)	Viral Marketing	3 (4.3%)
	Advergaming	0 (0%)
	Advercation	0 (0%)
	Songs or music	0 (0%)
	Special effects	0 (0%)
Television	Special effects	0 (0%)
	Songs or music	0 (0%)

5.3.4 Focus Group Themes

This study yielded three themes on participants' perspectives and experiences with food and beverage messaging:

1. Visuals and appealing designs: Characteristics of food ads
2. Promotional preferences: Influence of messaging on purchase decisions
3. Participant experiences: Reflections on advertising in daily life

These themes transition from focusing on the specifics of food advertising in Theme 1 to describing broader view of the participants' experience with food and beverage messaging in Theme 3.

Theme 1: Visuals and appealing designs: Characteristics of food ads

This theme describes the features that participants notice in the advertisements they see daily, including bright colours, big and fancy fonts, appeals to humour, characters, and dramatic and appealing food images. Participants discussed the features, designs, and techniques that they see in food and beverage advertising, and their responses were about both traditional advertisements on billboards and posters, as well as trendy digital ads in static and video forms. Most participants stated that food ads have bright colours and big fonts that draw people's attention to the product. These colours are sometimes a brand's signature colour and theme, and it is featured consistently across its advertisements.

Participants discussed how different brands used licensed and branded characters in their advertisements to appeal more to children. This technique was also used in addition to others to make it more effective. For example, a participant recalled how the cheestring mascot on the packaging always plays different sports. He could be skateboarding on one and playing hockey on the next one, referencing engagement in fun or physical activity. They also noted that ads often had discounts, deals, games, appeals to humour and celebrities. One participant said: "I think they did have a lot of the same characteristics having, like, brighter colours to capture your attention, and most did have, like, a deal or like some sort of, like, offer on the product. So, most were just having low prices, or having deals, coupons, stuff like that." (Participant 22, 15 years)

Participants also discussed how food ads focus on making the product look particularly appealing, often more appealing than when one purchases the product in reality. Advertisements did this by making the product bigger in size, accentuating and often exaggerating the texture and content of the product. One participant said: "...a lot of times in the advertising, they make them look really appealing or like crunchier than they are. Like more like filled with stuff than they really are, making them seem more like delicious for people to want to get them, especially in like pizza ads and stuff. How they always like, see like the

cheese stretching and stuff. It's just like appealing to your brain like, "I want to eat that." (Participant 8, 14 years). Overall, the same advertising features were mentioned by both age groups, with the exception that only the 15–17-year-olds mentioned the presence of celebrities/influencers. This is described below.

Theme 2: Promotional preferences: Influence of messaging on purchase decisions

This theme focuses on components of messaging and promotion highlighted by the youth believed to influence their purchase decisions and product consumption. It is divided into two subthemes: reward-driven choices and popular characters/celebrities.

Subtheme 1: Reward-driven choices

Messaging and promotion influenced participants differently, in that some participants reported being more likely to purchase and consume products depending on what kind of advertising by which they believed they were influenced. Many participants stated that were influenced by deals and loyalty rewards and were more likely to consider purchasing products when it was cost-saving. The kinds of rewards that influenced participants varied by settings, including coupons in the mail, restaurant sales, in-store discounts and price deals; however, digital rewards through in-app promotions appeared to be the most influential. These in-app promotions included points for making purchases, free drinks for prolonged brand application usage or multiple purchases and in-app meal offers. One participant said: "The digital side of it is definitely big now for teenagers. I feel like when you see 'buy this, earn points,' it's more appealing to us than, you know, buy one, get one free because if, you know, most people these days, if it's on your phone, you're just going to want it. Digital points is more valuable in the teenager's eye, I guess." (Participant 13, 14 years). Another responded that: "Yes, like, if I can see, like, I can go on my app now, and I can see how many points I have and, like, you know, if I have enough for, like, say like whatever, you know, if I have enough for something right now, and it gives you all these different kinds of options of what you have enough for. Well,

then I'm gonna go, and I'm gonna get it” (Participant 9, 13 years). These brand applications were mostly from restaurant chains. One participant said: “I use, like, the Starbucks app and the Tim's app and, um, like, McDonald's and stuff, and I like some of them because they can give me, like, free drinks and stuff.” (Participant 12, 13 years).

Subtheme 2: Celebrities and characters

Some participants, on the other hand, were more influenced by celebrities and characters, and they made purchase decisions based on their presence on product packaging and in advertisements. Celebrities' description of a product and its quality was influential enough to lead to the purchase of a product, even if it was more expensive than what is obtainable from other brands. One participant said: “Okay, so the ad on the right, that's the most popular YouTuber, the most famous YouTuber. So, I bought one of the chocolates to try it out also. So, like, I would say that the advertisement worked on me.” (Participant 14, 15 years). Branded characters on product packaging also played a significant role in purchase decisions, as participants were sometimes more interested in the characters than the product itself. One participant recalled: “For me, I found that, um, I wanted the like special Mario Oreos, but not for like the food themselves. I wanted it for an art reference for the packaging. So I got, so I wanted to get those for not for like the food itself but for the thing it was collaborating with.” (Participant 8, 14 years).

Theme 3: Participant experiences: Reflections on advertising in daily life

This theme describes how participants experience ads daily and the context in which they do. It focuses on the brand and food products they see the most, continuous exposure to advertising, and the breadth of settings. It also discusses their perceptions and reactions to the ads they see daily.

Participants saw ads for numerous products and brands daily but reported that they saw more fast food brands and soda. McDonald's, Pepsi, and Coca-Cola were the brands that participants

recalled seeing most commonly across multiple settings. Advertising for these brands was seen on vending machines, billboards, gas stations/convenience stores, social media, and music streaming platforms. When we asked if participants saw advertising for the same brands across multiple settings, one said: “I think there was an instance it just happened once or twice where, when I was watching YouTube on my TV, I got a McDonald's ad. I didn't get a chance to get a picture of it, and I also saw like a McDonald's billboard on the road, and so I didn't get just a picture of that either, but, just things like that, like, on my phone and also like outside, like, on billboards or on, like bus stops or whatever, or something like that. Yeah, mostly, just mostly fast food brands I found most commonly were the ones that I would see more than once.” (Participant 17, 17 years).

Participants also recalled that many brands use common marketing techniques depending on the product category advertised and the marketing channel. For example, fast food ads, in any setting/media, tended to have brighter colours, while advertisements on social media were often in the form of short videos or skits that had music and animations. A product advertisement from one brand sometimes leads to the desire for that product in general rather than from one from the specific brand. For example, a participant said he would want “whatever (product) it's advertising, doesn't have to be from the specific place”. They also suggested that the continuous exposure to food advertisements across settings increased the desire for those advertised products. One participant said: “They influence me in my day-to-day life, no doubt. Um, I think it's more common to crave something when it's, the advertisement is say, like, right in front your face, everywhere you go than just to be thinking about saying, “Oh, I want this food,” but if it's like, out in front of you every day and, like, say, there's an advertisement beside my school so every time, we drive in and out of the school, we see it. That's going to cause us to crave it more. So, putting it in a local busy spot does make it more attractive.” (Participant 21, 16 years).

Participants' reactions to ads were also influenced by the context in which they experienced them. Some advertisements were more powerful due to participants having previously seen those ads or consuming the products. This feeling of familiarity or nostalgia influenced participants' desire for those products. One participant said: "Um, I like Smile Cookie Week because I had it a lot when I was younger, and whenever they are sending out ads and stuff, saying that it's coming up, I get like excited. So, I ask my mom to take me." (Participant 12, 13 years). Other factors that contributed to some advertisements being more influential were participants' proximity to the settings where they could purchase the products and the ability of a product to satisfy a current physiological need. For example, participants reported that they were more influenced by a food advertisement when hungry and by a cold drink advertisement on a hot day. One participant recalled: "I like the summer drink at Starbucks because they always make the drinks look cold and refreshing on the ads while it's so hot out" (Participant 11, 14 years).

5.3.5 Comparison of Content Analysis and Focus Group Themes

The use of price promotions, incentives, or giveaways was the most common indicator found in the content analysis, and this aligned with the focus group data as participants in most focus groups talked about the presence of deals, sales, coupons, and gifts in the advertisements they often see. It was also one of the techniques that appealed to participants the most. The presence of characters was also consistent between the focus groups and the content analysis.

Some marketing features showed up in one dataset more than the other. In the focus groups, participants reported that most advertisements have bright colours and big fonts, but this was observed less often in the photos submitted. Appeals to fun also showed up much more in the content analysis compared to the number of times they were discussed in the focus groups. It was the third most common indicator in the content analysis, but it only came up in two focus groups. Calls-to-actions was an indicator only present in the content analysis.

5.4 Discussion

In this study, we explore participants' perspectives and experiences with food and beverage messaging in their daily lives and evaluate the marketing techniques used by food and beverage brands across settings. Our study found that youth 13-17 years old in NL are exposed to numerous marketing techniques daily. Our content analysis of food marketing indicators in the submitted photos revealed that price promotions, incentives or giveaways, and calls to action were the most common marketing techniques used, at 34% and 32.6%, respectively. These indicators were present across settings, but mostly on social media, as many of the advertisements they see and engage with are on social media. Some notable features of ads that our participants talked about in the focus groups were the presence of deals, appeals to humour, bright colours, characters, and celebrities/influencers. Deals and appeals to humour, fall under a common appeal classification used in marketing: emotional, rational, and moral appeals.[214] Emotional appeals utilize positive elements like humour, joy, or negative appeals to evoke responses and drive consumers to purchase a product.[214] One of our participants gave an example of this appeal where the branded character on a product is seen engaging in different sports. Emotional appeals often try to create a likable brand image that influences a positive perception of the product.[215] Some other emotional appeals are enjoyment, adventure, freedom, family, etc.[215,216] On the other hand, the rational appeal focuses on showing the product's benefits in terms of its quality or value.[214] This could include references to being cheap, healthy, convenient, etc.[215] Deals would be an example of a rational appeal in our study.

Marketing techniques influence the desire for certain products, the intent to purchase them, and the actual purchase and consumption of these products.[99] Our study found that reward-focused food advertisements, usually involving deals, incentives, and loyalty rewards, were more appealing to many of our participants. This also emerged in our content analysis as

the most common food and beverage marketing indicator. This is similar to a mobile application study that found that special offers were the second most common indicator of teen-targeted food marketing identified by their participants. The study also classified contests, membership rewards, and seasonal rewards as special offers.[78] Similar to our findings, cost-saving offers were the most common in this study. There is limited evidence on how loyalty programs on fast food restaurant apps influence youth. However, there is a need to study this due to the growing presence of these programs among fast food brands, as observed in our study. It is also important to study it as it makes cheap fast food even cheaper. These programs often offer customers price discounts, incentives, gifts, rewards, and loyalty-based tiered services, leading consumers to develop favorable attitudes toward the brand.[217] While they build a loyal consumer base for brands, they could also increase the consumption of unhealthy food products, as some of our participants mentioned that they were more likely to purchase products or patronize a brand when they received in-app discounts and rewards from fast food brands.

Our study also found that participants were influenced by celebrities and characters. We found that 15-17-year-olds were more likely to talk about the presence of celebrities in ads and the influence that it had, while 13-14-year-olds spoke more of branded and licensed characters. In a study exploring teen-targeted food marketing techniques among 13-17-year-olds, participants selected both celebrities and characters as indicators of teen-targeted marketing, although the researchers considered characters to be more of a child-targeted marketing technique. The study also found that 13-14-year-olds were more likely to consider characters as teen-targeted marketing than their older counterparts, as we saw with our study participants.[218] This showed the difference in the appeal of food marketing techniques according to the age of the audience. Numerous studies focus on the effects of characters on children under the age of 12 years[112,219–221]; however, it is also essential to explore how

licensed and branded characters influence older children, particularly the potential of leaving a lingering positive impression from childhood through adulthood.[222] Celebrities and social media influencers are increasingly used in social media food marketing advertisements[223], which are mostly for unhealthy food products high in sugar, sodium, and fat.[224] A systematic review found that celebrity presence and endorsements in food and beverage advertisements increase adolescents' preference for and consumption of unhealthy food and beverage products.[225] The influence of celebrities and influencers cannot be underestimated, as they significantly impact people's health-related behaviours through various social, psychological, and physiological mechanisms.[226]

Fast food and soda were the most common products that our participants said they often saw advertised across different settings, and the fast food ads were usually from McDonald's. Our analysis of the photos confirmed this as fast food ads were seen on billboards, in recreational settings, Spotify, Snapchat, websites, TikTok, Instagram, mailed flyers, apps, Facebook, and YouTube (data not shown). A study assessing the impact of marketing on fast food intake and brand preference using the 2019 International Food Policy Study Youth Survey found that 78.9% of Canadian respondents aged 10-17 self-reported exposure to McDonald's marketing in the past 30 days, higher than Subway (68.8%) and Kentucky Fried Chicken (48.4%) marketing.[227] This shows that McDonald's is one of the most popular fast food brands in Canada and their products are widely advertised and viewed by adolescents, as per self-reported measures. One study that focused on teen-targeted food marketing across settings found that fast food and fast food brands were among the most common ads found by participants, with McDonald's being one of the top three brands.[78] Beverages like soda and coffee were also the most common product category.[78] This study presented the frequency of ads according to brand, product category, and setting rather than which brands or products were most commonly featured across multiple settings. Our participants also talked about how

repeated exposure to food marketing increased their desire for the product being advertised. Using a Hierarchy of Effects Model, repeated exposure to food marketing leads to an increase in brand awareness, which results in the development of favorable attitudes and preferences for the product promoted, purchase intent, and, ultimately, the purchase and consumption of the product.[99] Only a few studies have investigated the effect of cumulative food marketing exposures, and there is a need for more research on how continuous and repetitive exposures to food marketing shapes children's attitudes and behaviours towards food.[2]

Ads appealed more to some of our participants when the product satisfied a physiological need. In a study that compared children's snack intake after exposure to food and non-food advertising, their reported hunger levels were associated with their snack intake in both groups ($p < 0.001$). However, after controlling for the difference in hunger levels in both groups, there was still a significant difference between them ($p = 0.008$), with the advertising group consuming more.[228] This shows that even though hunger influences food intake, exposure to food marketing affects how much food people consume. Food marketing can also elicit a feeling of hunger as exposure to food messages in advertising can result in physiological and psychological responses that, depending on individual susceptibility, can lead to an intake of the advertised food.[229] Numerous studies have found that exposure to advertising has increased food intake among children and adolescents, as identified in multiple systematic reviews.[24–26,115] Also, food marketing can lead to changes in eating behaviours focused on food categories rather than specific brands. Children exposed to ads may crave any product within the category, not necessarily the advertised brand.[229,230] This was evident in our data where food advertisements encouraged appetite for food in general, not just the product advertised.

The results of this study have some implications for knowledge about exposure and the power of food marketing. Price promotions, incentives, and giveaways are significant across

settings, with app-based loyalty programs being a component of digital marketing techniques in the food and beverage industry. Social media is also a platform with many marketing instances, including video advertisements that could utilize multiple techniques. Lastly, licensed, branded, and other cartoon characters are used in advertisements across settings, making them more appealing to youth.

5.5 Strengths and Limitations

This is the first study in NL and, to our knowledge, the third in Canada that has attempted to explore food marketing to youth across various settings. The other two studies[78,79] only instructed participants to take photos of teen-targeted food marketing through a mobile application, as opposed to ours where participants were asked to take photos of all food marketing instances that they saw. The focus on “teen-targeted” food marketing in these two studies means that they only explored a segment of food marketing exposures, rather than cumulative exposures, which further underestimates the extent of advertising that youth see and are influenced by. This study provides a snapshot into participants' daily lives and the breadth of settings where they are exposed to food marketing. This study used a digital data collection tool, making it easy for youth to participate in our research and making food marketing data easily accessible. It also provided perspectives and experiences from participants directly on what kind of ads they see and the techniques that appeal to them using focus groups and content analysis. Another strength is that this study used Health Canada’s protocol for the content analysis, and this standardizes the coding of food marketing indicators, allowing for consistency and comparison with future research.

This research was conducted as part of a mobile application feasibility study for monitoring food marketing exposures among youth and had a small sample size. There was also a small number of marketing instances submitted and it was not based on full exposure, but the ones that our participants noticed. Therefore, the results from this study may not be

generalizable across the food marketing landscape in NL. Also, this study did not set out to measure food marketing and cannot be used to estimate the true exposure and power of food marketing in the province. As participants were required to take photos and screenshots of marketing, there is a high possibility that not all the marketing techniques from video ads were captured, therefore underestimating the power of food marketing on social media. We did not use every photo for photo elicitation in the focus group, so not all photos were discussed by participants. This could underestimate the power of food marketing as experienced by our participants.

5.6 Conclusion

Youth captured exposure to numerous messages in food ads daily through our mobile app, FoodMATS-Youth. Food marketing exposures were believed to impact their food preferences and behaviours. Participants in our study captured instances of multiple food marketing techniques, including brand mascots, licensed characters, bright colours, appeal to humour, celebrities/influencers, calls to action, and deals, representing the diverse power of food marketing. Price promotions, incentives, giveaways was the most common indicator in the content analysis, and it was frequently discussed in the focus groups showing a relationship between the techniques that marketers use and what youth are influenced by. It is important for monitoring efforts to explore the connection between the marketing techniques that influence youth and those present in child- and teen-targeted food marketing. This study also found that youth are being exposed to numerous forms of food marketing on digital media, and there is a need to monitor this changing food marketing landscape as marketers can now reach youth more easily. The findings from this study show that youth are exposed to food marketing across numerous settings daily and food marketing regulations are necessary to protect children from these exposure. It also shows the need for more research on youth's cumulative exposure to food marketing across multiple settings.

Chapter 6: Concluding Discussion

This chapter provides an overall summary of the thesis' contribution to knowledge, some policy recommendations arising from the findings, its strengths and limitations, and some directions for future research on food and beverage marketing to youth in Canada.

6.1 Summary of Thesis and Contribution to Knowledge

Unhealthy food and beverage marketing influences children's attitudes, preferences, and behaviours toward food.[2] Food marketing to children in Canada is mainly self-regulated,[72] creating loopholes for the food and beverage industry to target children. Most research studies on children's exposure to food marketing focus on single settings and media, potentially underestimating food marketing exposure.[78] Exploring the nature, extent, and power of food marketing to children across settings is essential. This research study focused on testing the feasibility of a mobile application to assess food and beverage marketing exposures among youth aged 13-17 years old in NL and exploring their experiences and perspectives on the food and beverage messaging they encounter daily. We created the Food and Beverage Marketing Assessment Tool for Settings and Youths (FoodMATS-Youth) hosted on the Catalyst by MetricWire mobile application to examine food marketing across multiple settings and media.

The first manuscript focused on testing the usability and acceptability of the mobile application. Twenty-three participants took photos (including screenshots) of food marketing over three days and completed a feedback survey and one focus group each. The findings from this study demonstrated that the mobile application is highly feasible for monitoring food and beverage marketing exposures across multiple settings based on its high ease of use, convenience, responsiveness, and navigation ratings. The user experience was mostly positive, and participants provided recommendations for improving user engagement. There was also

no difference in the feasibility outcomes according to age group. This mobile application has excellent potential to contribute to Health Canada's food and beverage marketing monitoring efforts through crowdsourcing marketing instances from youth, and the utility of the mobile application can be further explored in larger-scale studies. A limitation identified in the use of this application was that participants did not submit all the photos of marketing they saw, potentially underestimating exposure.

The second manuscript explored participants' experiences and perspectives on food and beverage messaging. It involved photo elicitation in focus groups and a content analysis of food marketing instances recorded by participants. This study found that youth in NL notice exposure to numerous marketing techniques and messages in food and beverage advertising daily. It showed that marketers employ techniques that aim to reach consumers generally and those that target youth specifically. Youth reported being influenced by specific types of marketing techniques, whether they were cost-saving, like deals, discounts, or ones that contained familiar characters or celebrities. More generally, advertising sometimes influenced youth due to repeated exposure, nostalgia, proximity to food settings, and physiological needs like hunger and thirst. The content analysis showed that price promotion, incentives, or giveaways were the most common food marketing indicators to which our participants were exposed.

6.2 Policy Recommendations

Social media accounted for the most ads our participants saw in a single setting/medium, which shows the changing food marketing landscape. This highlights the importance of regulations around social media marketing for food and beverage brands and social media platforms. Despite a significant portion of the ads being on social media, youth were still exposed to numerous ads in food retail settings, packaging, and recreational settings, echoing the need for continuous monitoring of food marketing to youth to identify

settings/media of exposure. Price promotion, incentives, or giveaways were found in one-third of the food marketing instances, raising concerns about how these encourage the purchase and consumption of unhealthy food products. This also has to be properly accounted for in monitoring efforts and in regulatory considerations. Although Health Canada's plan to restrict food marketing to children on television and digital media[77] is laudable from a public health perspective, this study has shown that the youth notice food and beverage marketing from other settings, too. For regulations to reduce exposure to the marketing of unhealthy foods and beverages to children, the regulations may need to include more settings. The self-regulation of marketing by the food and beverage industry has not proved effective[94], and this calls for mandatory provincial and federal government regulations that aim to protect children.

6.3 Strength and Limitations

The strengths and limitations of each manuscript have been explored in the appropriate sections. This thesis had numerous strengths. First, it led to developing a digital tool for monitoring food marketing to youth across settings. It also adds evidence to the limited literature on the feasibility of mobile applications for data collection in academia. This is also the first study in NL that has explored food marketing to youth across multiple settings, providing perspectives from youth in the province. Another strength lies in its use of Health Canada's list of marketing indicators for content analysis, as this contributes to consistency in tracking food marketing techniques over time and across settings and media. This study also utilized photo-elicitation in focus groups, allowing for rich descriptions of participants' perspectives, experiences, and reflections and allowing for a more participatory approach to food marketing research.

Concerning limitations, this study had a small sample size, limiting the generalizability of the findings. This study cannot be used to measure the true extent and power of food marketing in the province; it only provides a snapshot of what a group of youth in NL are

exposed to and the marketing instances noticed by participants. Not all photos of food marketing instances were submitted, therefore underestimating exposure. Confirmation bias could have also made some participants more likely to notice and report marketing instances that align with their existing beliefs or expectations about unhealthy food marketing, further underestimating exposure. However, this study does provide information on the most impactful food marketing to our participants, which may have important policy implications.

6.4 Future Directions

A great deal of research has been carried out on unhealthy food marketing in Canada[44,47,48,52,78,231–233] and most of these studies focused on food marketing exposure. This thesis contributed to the literature on the power of food marketing across settings and media in a Canadian context. However, this study also identified numerous gaps that are worthy of exploration. Research on the power of food marketing to youth on social media should include all video ads that youth see directly from brands and social media influencers, when applicable. Studies that have evaluated food marketing on social media have focused on just photo ads, the extent of exposure, and the power of exposure in subsets of video ads (e.g., influencer videos) or very limited video samples. This might underestimate the power of marketing and may not be representative of actual exposure. Methodological constraints and resources may pose a challenge; however, this source of food marketing must be explored as much as possible in order to fully understand the persuasive techniques used to target youth. Other areas of food and beverage marketing that need to be further studied include the influence of fast food brand loyalty programs on youth, the impacts of continuous and repeated exposure to food marketing, and finally, the power and extent of food marketing to youth across settings.

In conclusion, youth are exposed to unhealthy food marketing across settings, and it has a significant impact on their food choices and consumption.[1] To protect them from the harmful impact of food marketing, the WHO is calling for mandatory policies to protect

children of all ages.[234] As researchers, we can contribute to comprehensive monitoring of food environments to influence policy changes and keep the government and private sectors accountable.[235] This thesis has contributed to the assessment of food marketing in NL and has resulted in the development and testing of a digital tool to monitor food and beverage marketing exposures on a larger scale. This work highlights opportunities for policymakers to use research findings from digital tools to inform comprehensive regulations on food marketing to support the health of youth.

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Appendices

Appendix A: Health Research Ethics Board Approval Letter



Research Ethics Office
Suite 200, Eastern Trust
Building
95 Bonaventure Avenue
St. John's, NL
A1B 2X5

April 18, 2023

4M126 Faculty of Medicine,
300 Prince Phillip Drive
St. John's, NL

Dear Mr. Bamigbayan:

Researcher Portal File # 20231737
Reference # 2023.052

RE: A Day in the Life: Exploring exposure to unhealthy food marketing in youth living in Newfoundland and Labrador through a novel mobile application.

Your application was reviewed by a subcommittee under the direction of the HREB and the following decision was rendered:

X	Approval
	Approval subject to changes
	Rejection

Ethics approval is granted for one year effective April 18, 2023. This ethics approval will be reported to the board at the next scheduled HREB meeting.

This is to confirm that the HREB reviewed and approved or acknowledged the following documents (as indicated):

- Consent and Assent forms for parents and youth dated 13Apr2023, approved
- Janeway Research Proposal dated 13Apr2023, approved
- Demographic Survey dated 12Apr2023, approved
- Information letter to parents and emails to principals and community youth networks dated 12Apr2023, approved
- Research Poster Ads 1 and 2, approved
- Screenshots of mobile app, acknowledged
- Instruction/Training for youth on MetricWire app setup, acknowledged
- Feedback Survey and Focus Group guide, approved

Please note the following:

- This ethics approval will lapse on April 18, 2024. It is your responsibility to ensure that the Ethics Renewal form is submitted prior to the renewal date.
- This is your ethics approval only. Organizational approval may also be required. It is your responsibility to seek the necessary organizational approvals.
- Modifications of the study are not permitted without prior approval from the HREB. Request for modification to the study must be outlined on the relevant Event Form available on the Researcher Portal website.
- Though this research has received HREB approval, you are responsible for the ethical conduct of this research.
- If you have any questions please contact info@hrea.ca or 709 777 6974.

The HREB operates according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2), ICH Guidance E6: Good Clinical Practice Guidelines (GCP), the Health Research Ethics Authority Act (HREA Act) and applicable laws and regulations.

We wish you every success with your study.

Sincerely,



Dr. Robert Mercer, Acting Chair, Non-Clinical Trials
Health Research Ethics Board

You Have Received Ethics Approval. Now What?: HREB Reporting Requirements

Once a study has received ethics approval from the Health Research Ethics Board (HREB), there are still associated reporting requirements. In the conduct of approved research researchers are required to report to the HREB, in a timely manner, proposed changes from approved research that affect participants at any stage of the process. This includes, but is not limited to, changes to the consent form, changes to the tasks or interventions involved in the research, or changes to measures to protect privacy and confidentiality.

Any substantive change to the research should not be implemented prior to documented approval by the HREB, except when necessary to eliminate an immediate risk(s) to the participants. Below are examples of post approval documentation that must be submitted to the HREB:

Amendments

Any proposed change in the conduct of a study must be submitted to the HREB, and approved, before the change may be implemented. Such changes might include modification of recruitment procedures, inclusion or exclusion criteria, revised sample size, addition or deletion of study sites, changes to an intervention, consent forms, questionnaires or scripts, etc. If there are changes in project team members or changes to funding source(s)/sponsor(s), there are specific forms to complete to report this to the HREB.

Adverse Events

Serious and unanticipated adverse events that occur within Newfoundland and Labrador are required to be reported to the HREB. Such events may occur in both clinical trials and in other types of research, e.g. collapse during a rehabilitation program, emotional breakdown requiring follow up care during an interview, or breach of privacy during correspondence. Serious adverse events that are fatal or life-threatening are required to be reported to the HREB as soon as the research team is aware of the event.

Protocol Deviations

Deviations from an approved study protocol must be reported to the HREB. Changes that eliminate immediate hazards to participants do not require prior approval, but must be reported soon as reasonably possible.

Safety Reports

Safety reports providing information on all serious adverse events (SAEs) occurring in a clinical trial must be provided by the sponsor to the HREB, normally on a three or six monthly basis (i.e. in accordance with the specified reporting timelines that were outlined in the approved ethics application).

Investigator Brochure (IB) and Product Monograph (PM)

Throughout the course of a clinical trial, changes may be implemented to study documents. All revisions to approved study documents must be submitted to the HREB to ensure the record is up to date. If the revisions include new risk or safety information there may be a requirement to notify research participants.

Ethics Renewal/Study Closure

Ethics approval lasts for one year. Ethics renewal is required annually, on the anniversary of the date of the HREB notification of approval. Once data collection is no longer ongoing, a study closure form is required to be submitted to the HREB for the study to remain active or to be closed in good standing.

Appendix B: Recruitment Poster

Participants Wanted

If you are a parent or guardian of a child between the ages of 13-17 and living in Newfoundland & Labrador

Your child is invited to participate in a study about food marketing

As a gesture of gratitude, you will be offered a \$30 e-gift card for participating in this study.

If you have any questions about this project, please contact me by email at iobamigbayan@mun.ca or Dr. Rachel Prowse at rprose@mun.ca. If you have ethical concerns about the research, such as your rights as a participant, you may contact the Ethics Office at info@hrea.ca or by telephone at 709-777-6974.

iobamigbayan@mun.ca



Appendix C: Recruitment Email to Community Youth Networks

Dear X,

My name is Idris Bamigbayan, and I am a Master's student in the Faculty of Medicine, Memorial University of Newfoundland. I am conducting this study as a part of my Master's degree under the supervision of Dr. Rachel Prowse. The purpose of this study is to explore the use of a smartphone to document food marketing faced by youth in Newfoundland in their daily life.

As part of this study, we are reaching out to Community Youth Networks in Newfoundland to recruit participants. After receiving consent from the parent/guardian and the child, the child will download a mobile app for the study. The child will upload photos/screenshots of food marketing they see in their daily life over a period of 3 days. They will be asked a few short questions about each ad, such as the appeal of the ad, and various marketing techniques (e.g. use of celebrities). Participants will also be invited to a focus group to share their experience.

Please reply to this email by DATE to confirm if you agree to share our information letter and poster with the parents/guardians of youth between the ages of 13 to 17 at your centre. If you would like us to send paper copies of the attached information letter and poster, please include the number of copies needed in your response.

If you have any questions about this project, please contact me by email at iobamigbayan@mun.ca or Dr. Rachel Prowse at rprowse@mun.ca

Thank you in advance for considering taking part in our project,

Sincerely,

If you have ethical concerns about the research, such as your rights as a participant, you may contact the Ethics Office at info@hrea.ca or by telephone at 709-777-6974.

Appendix D: Social Media Recruitment Caption

Are you 15-17 years old and living in Newfoundland and Labrador?

Take part in our study exploring unhealthy food marketing faced by youth in NL. Simply, download our mobile app, upload photos of food marketing you see over a period of 3 days and share your experiences using the app.

For participating, you will be offered a \$30 e-gift card. Click on the link below or scan the QR code on the poster to get started. You will be contacted with further information. Thank you in advance for considering taking part in this project!

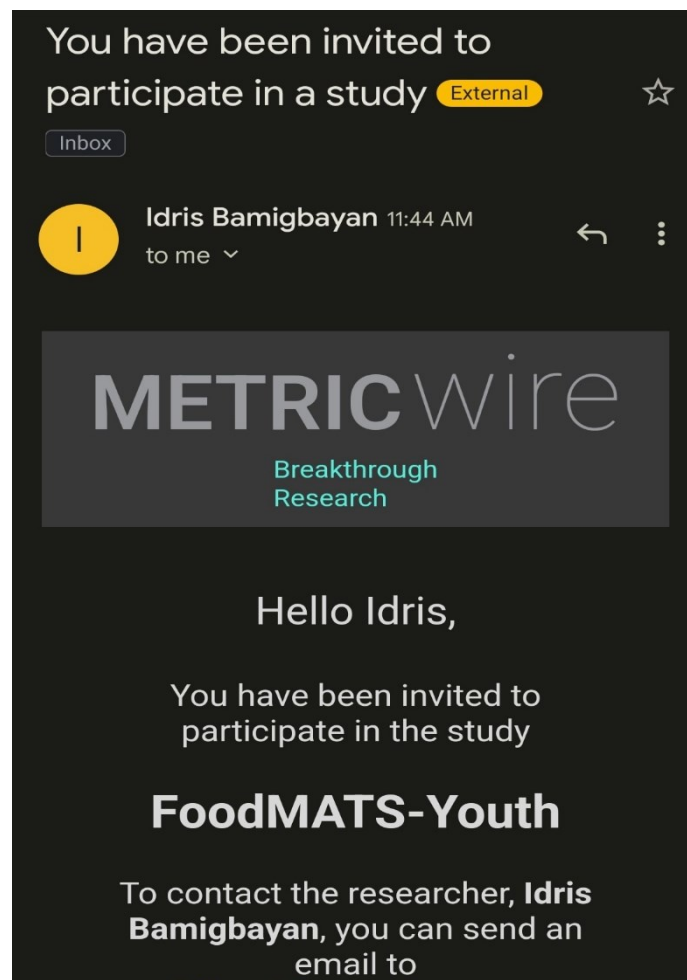
If a video ad is made, the above text will be used as is or shortened. Same applies to the photo ad.

Appendix E: App Training Manual

MetricWire App Instructions

Thank you for your participation in this study. This resource provides some training on using the Catalyst by MetricWire app for this study.

1. After you get an invite to this study as an email or text message, click on the button that says “Click here to join the study” link, and it will take you to the Play Store on Android devices or the App Store on IOS devices. Click install and make sure your device is connected to a mobile or WIFI network.



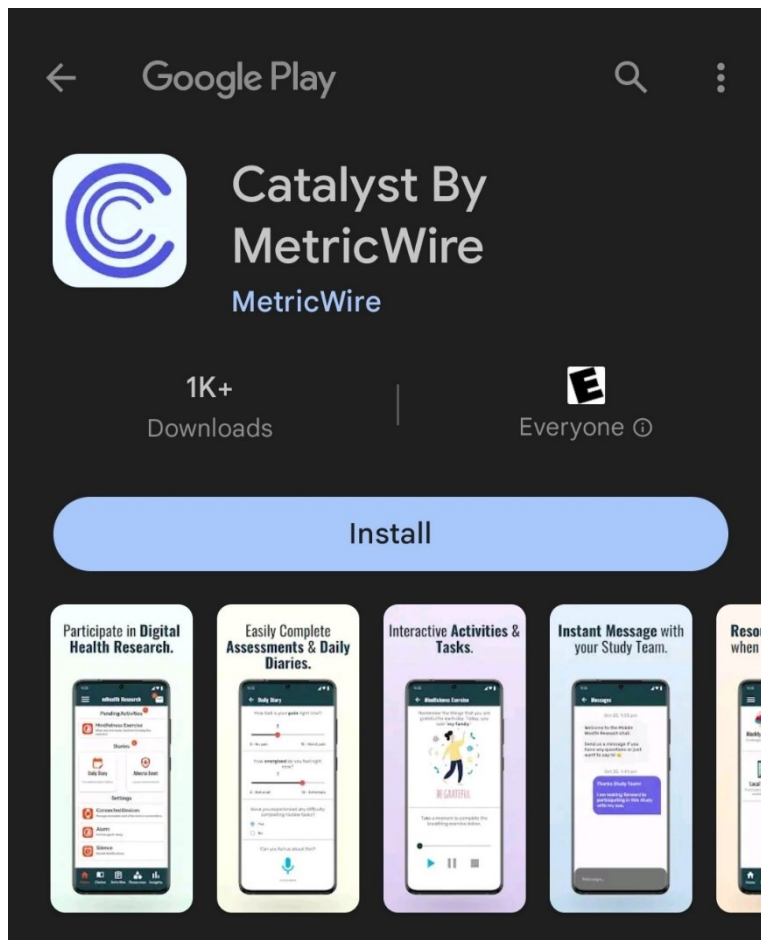
[Click here to join the study](#)

Having trouble joining the study from the link above? Download the apps from the appstores using the one of the following links:

iOS App

Android
App

Should any questions about the platform arise, or if you are receiving this email by mistake, email us at support@metricwire.com. By downloading and installing the application, you hereby agree to MetricWire's [Privacy Policy](#) and [Terms of Use](#).



2. After installing the app, you will see the study and an option to login or create your account.




3. After clicking on that option, you will be prompted to create a password that is at least 8 characters. It should prepopulate the email section; if it does not, you should enter the email address on which you received the study invite.

Catalyst
Powered by Metricwire

Login or Create Your Account

Email Address

Password 

Submit

[Back](#) [Forgot Password?](#)

4. After entering a password and clicking submit, you will be asked to confirm the password. Enter the same password again and click "Sign Up."



Create New Account

Email Address

Password

••••••••



Please confirm your password 

Your password and confirmation must match

Sign Up

[Back](#)

[Forgot Password?](#)




5. After signing up, the consent information screen below will appear. You should click on it and complete it.

☰ FoodMATS-Youth ☑

Current Tasks¹

New

 Consent Information

09 Jul 2023, 11:51 AM

← Consent Information ⌵

ethical concerns about the research, such as your rights as a participant, you may contact the Health Research Ethics Board at 709-777-6974 or info@hrea.ca. **The final decision about participation in our study is yours. If you have any questions about this project, please contact me by email at iobamigbayan@mun.ca or Dr. Rachel Prowse at rprorowse@mun.ca**

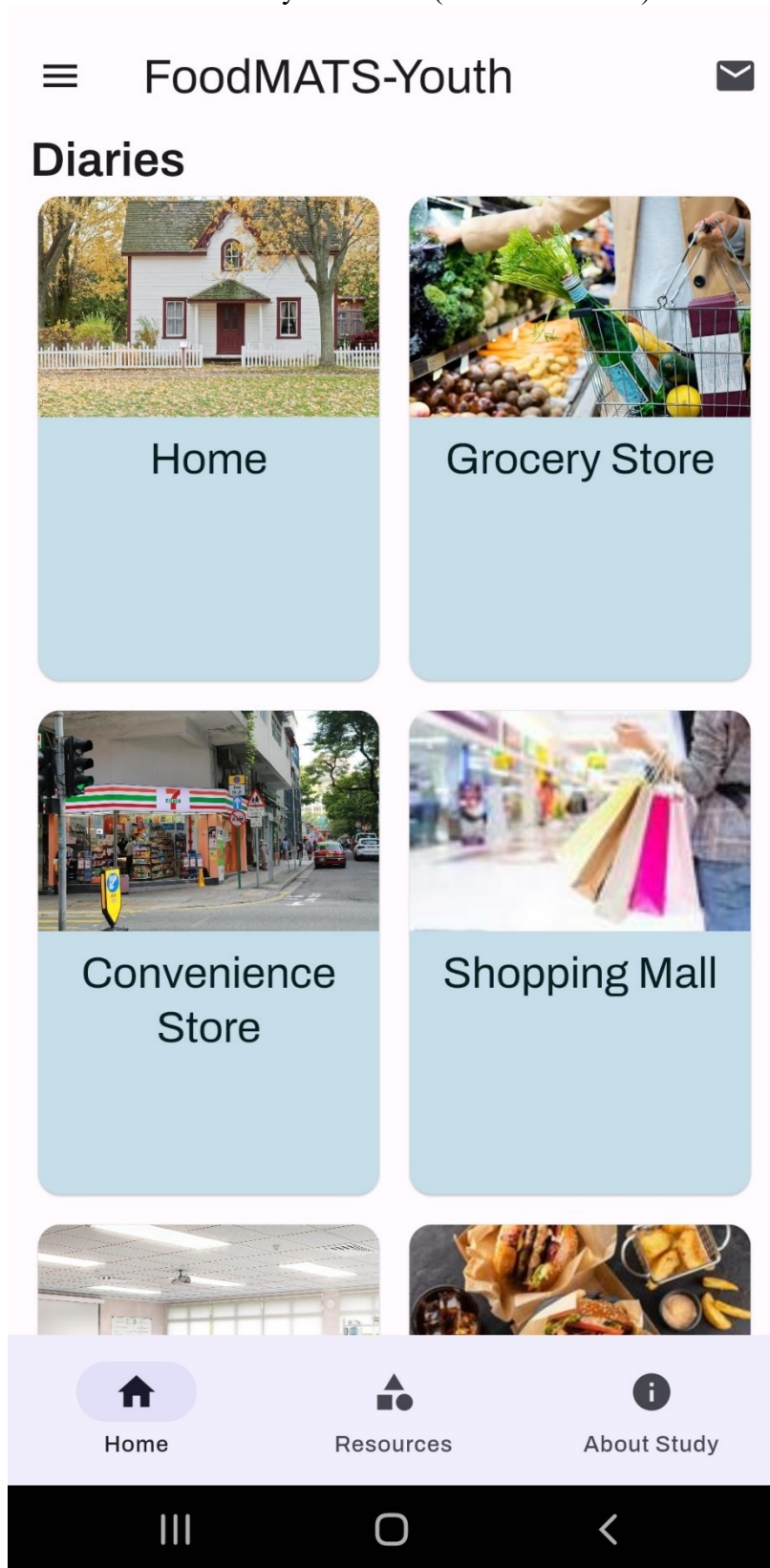
Do you agree to participate in this study?

Yes

No

Submit

6. You should then see all the locations below and more. When you see an ad, select the location, upload/take pictures of the ad, and then answer few questions. There is also an option to add a location of your choice (Other Locations).





Recreation and
Sport Centre



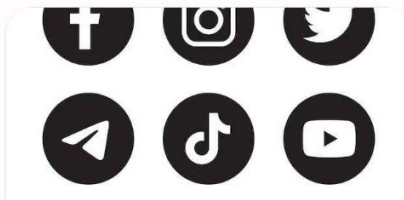
Movie Theatre



Youth Centre



Public
Transportation



Home



Resources



About Study



7. Submit your entries after answering the required questions.

The screenshot shows a mobile survey interface. At the top, there is a header bar with a back arrow, the title 'Grocery Store', and a 'Tr' icon. Below the header, the section is titled 'Photos of the ad' and contains a button labeled 'Add Photos of the ad'. The next question is 'What is the product or brand being promoted?' with a text input field containing the placeholder 'Enter text response'. The following question is 'Do you think this ad targets you as youth?' with three radio button options: 'Yes', 'No', and 'Don't know'. The final question is 'How much do you like this ad?' with a horizontal scale from 0 to 10. A blue bar is positioned at the 0 mark on the scale. At the bottom of the screen, there is a black navigation bar with three icons: a vertical bar, a circle, and a left-pointing arrow.

← Grocery Store Tr

Photos of the ad

Add Photos of the ad

What is the product or brand being promoted?

Enter text response

Do you think this ad targets you as youth?

Yes

No

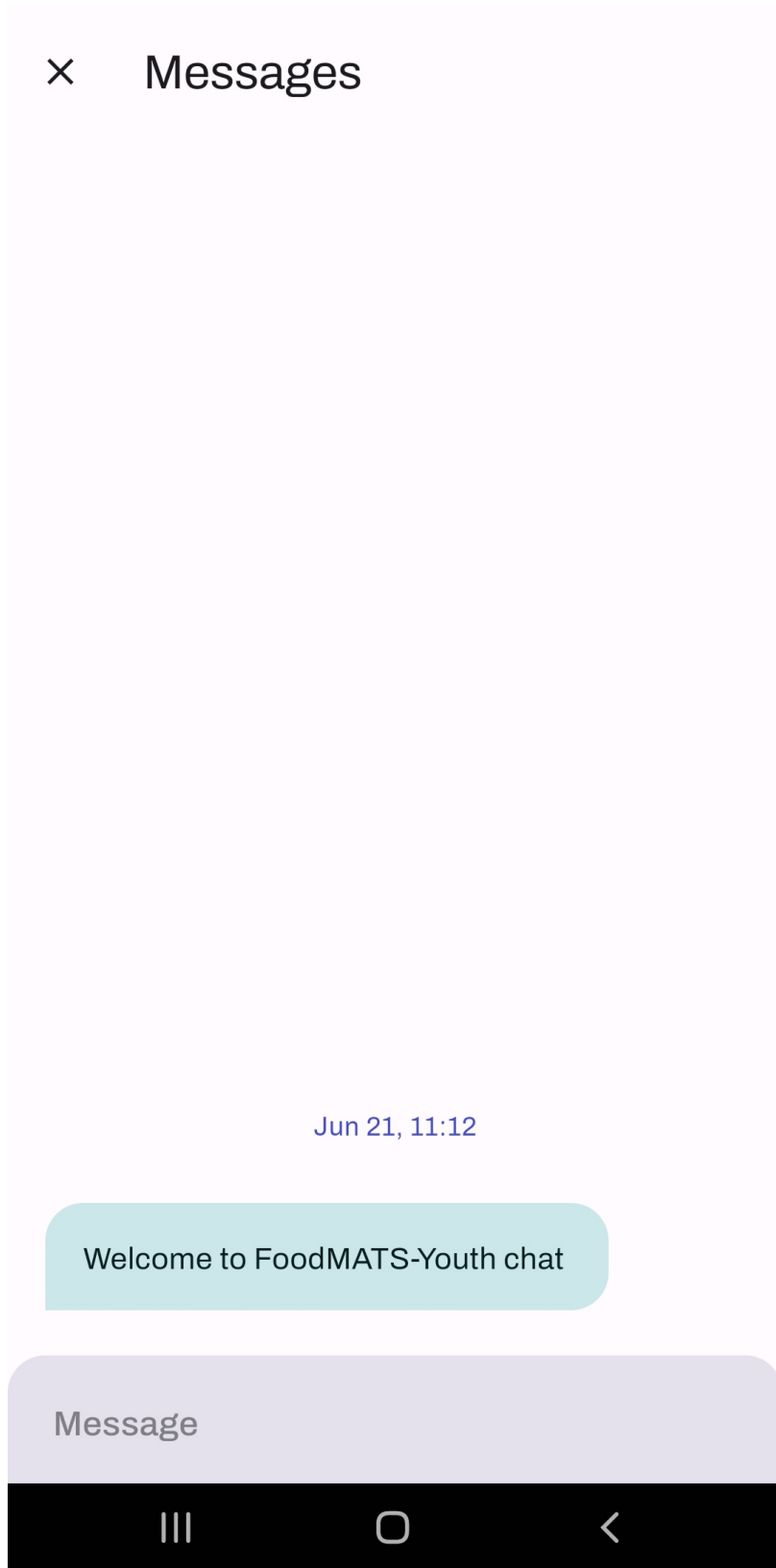
Don't know

How much do you like this ad?

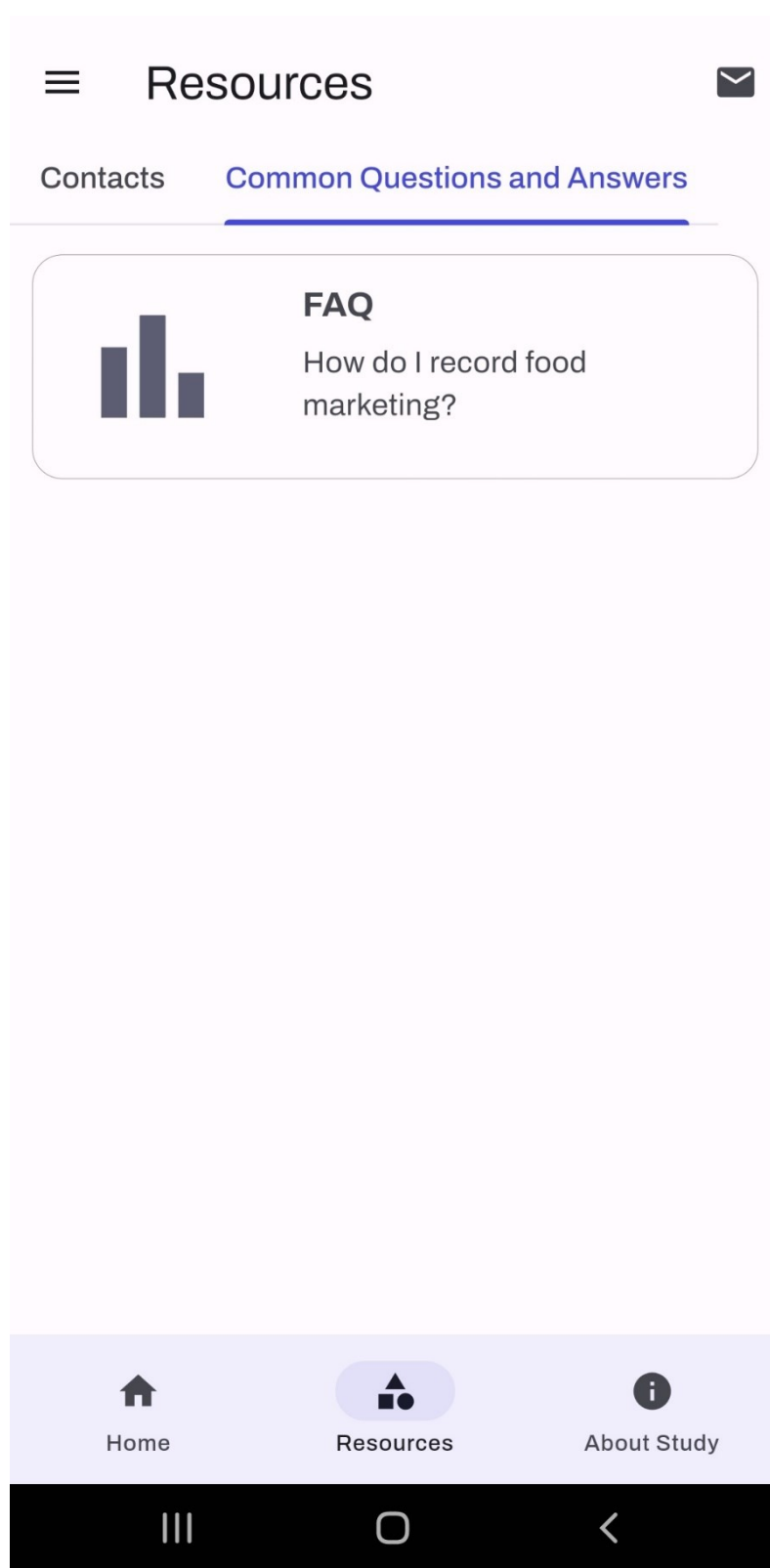
0

0 10

8. If you have any questions, just click on the message icon and have a chat with us. You can also reach out to us via email.



9. You can find important resources in the “Resources” section of the app. This includes a guide on what qualifies as food marketing and a page containing our contact details.



10. After using the app to record food marketing for 3 days, you will be able to complete the feedback survey. This is the final task using the app before you attend one focus group.



Current Tasks ¹



Feedback Survey

New

11 Jul 2023, 12:43 AM

Diaries



Home



Grocery Store



Convenience



Shopping Mall



Home



Resources



About Study



Appendix F: Focus Group Guide

Briefing

Hello everyone, my name is Idris, and I am conducting a study that tests the use of a mobile app to capture food marketing exposures youth face daily. You all have used this app already, and I am interested in learning about your experience using the app and your views on the photos you took. This information will help us understand how the app functioned, the problems you faced, the things you loved, and the things necessary to improve the app. Your participation will help us see this app from a youth perspective.

This focus group will last about one hour, and you can move around. If you need to use the bathroom, you can. This discussion will also be recorded to sufficiently capture your opinions and ideas. Everything said here is confidential, and we will not include your names in anything you say. The audio recording will also be destroyed after transcribing, and no identifying information will be included.

You may choose not to answer any question and withdraw from this focus group whenever you want. There are also no right or wrong answers, and you can have a different experience with the app than others in the group. We want everyone to participate freely, so we are asking you to respect each other's confidentiality and not share anything said outside this group. Please mute your cell phones so we do not get distracted.

If you have any questions now or later, feel free to ask me. Are there any questions before we get started? If it is fine by everyone, I will start recording and begin the focus group.

Questions

1. Tell me your first opinion about the app when you started using it?

Probe: Did that change over the course of the study?

2. You used this app for three days. What was it like to add the app use to your daily activities?
3. Tell me how you felt when you saw some ads outside and had to use the mobile app in public?
Probe: How was using the app at home different from using it outside?
4. What parts of the app did you love the most?
Probe: Why do you love those parts?
5. What were some things you often observed about the ads that the app did not account for?
Probe: Were any locations unclear?
Probe: Are there any other locations you think we should add?
6. Tell me about the problems you encountered when using the mobile app? (if any)
7. How did you feel when you received random notifications and prompts to record the ads you saw?
Probe: When will you have preferred to receive prompts and notifications?
8. What do you think we should change about this app?
Probe: What new features do you think we should add?
9. Looking at the photos you took and what you saw, what marketing techniques do you think these food brands use to appeal to youth?
Probe: What marketing techniques particularly appealed to you?
10. Tell me about a time when you saw a food or beverage ad that made you feel like, "I want that!" or "I would love to have that!"
11. How do you think food ads influence you?
Probe: What of your friends, how does it influence them?

12. Tell me about instances where you saw the same brand in different settings/locations.

13. Were there any similarities between the food marketing ads you saw? Were there any differences between the food marketing ads you saw?

Anything else?

Debriefing

This is the end of our focus group, and I will now stop recording. Thank you all for coming and for your participation. If you have anything else you would like to share, please feel free to do so. Please get in touch with me if you have any additional comments, questions, or concerns after leaving.

Appendix G: Consent Form

Parental Consent

Title: : A Day in the Life: Exploring exposure to unhealthy food marketing in youth living in Newfoundland and Labrador through a novel mobile application.

Researcher: Idris Opeyemi Bamigbayan

Phone Number: 709-725-4440

Supervisor: Dr. Rachel Prowse

Your child is invited to take part in a research project investigating youth food marketing exposures. This study is being conducted by Idris Bamigbayan, a graduate student in the Faculty of Medicine, Memorial University and under the supervision of Dr. Rachel Prowse. Your child has to be between the ages of 13-17 years, have access to a smartphone with internet access and live in Newfoundland and Labrador to participate in this study. Taking part in this study is voluntary.

This consent form has important information to help you make your choice. It may use words that you do not understand. Please ask the researcher to explain anything that you do not understand. It is important that you have as much information as you need and that all your questions are answered. Please take as much time as you need to think about your decision to let your child participate or not, and ask questions about anything that is not clear.

1. Why is my child being asked to join this study?

Your child is being asked to join this study because youth face a lot of unhealthy food marketing exposures and it is important to investigate where these exposures take place, how it does and how it affects them. This study will help us test if a mobile application can be used to capture the marketing exposures that youth face in their daily life.

2. How many people will take part in this study?

This study will take place in Newfoundland, Canada. The study will enroll a total of 24 people to test out the mobile app and we expect to have groups of 6 similar in age for the focus groups.

3. How long will my child be in the study?

This study is divided into two parts. The first part of this study involves the use of a mobile app to record food marketing exposures for a period of 3 days. The second part is a single focus group session for participants to talk about their experiences using the app and it is expected to last for 1 hour.

4. What will happen if my child takes part in this study?

If you agree to let your child take part in this study, the following procedures will take place:

- The first part will involve the child downloading a mobile app and completing the mobile diary provided on it based on the food ads they see in different settings/media i.e., grocery store, television, social media, etc. for 3 days. These diary entries are short and there are a few questions about the features of the food ads they see e.g., if it uses cartoon characters, celebrities or influencers. On the last day of using the app, they will complete a short feedback survey embedded in the app on its ease of use.
- The second part will be a single focus group with your child and 5 other participants. There will be a total of 4 focus groups and there will be 6 participants in each group. The focus groups will be arranged based on age and two groups will have 13–14-year-olds while the other two groups will have 15–17-year-olds. Participants will be randomly assigned to one of the groups in their age range. A focus group is a small group of representative people who are asked to speak about their opinions as part of the research. A moderator will organize the focus group. The focus group discussion will be about 1 hour in length and will either take place in person or virtually. The virtual focus group will take place on Webex and your child has the option of turning their camera off during the session. Your child will be asked to talk about their experience using the app to capture food ads and their opinions on the pictures they took. This will include app functionality, navigation, recommendations, etc. If it takes place in person, responses will be audio-taped, if it takes place virtually, it will both be audio-taped and video-taped. The recordings of the focus group will be transcribed, and the researchers will make sure to remove all identifying information, such as your child's name, from the transcripts.

5. Are there risks to taking part in this study?

There are no significant risks related to this study, but some participants might feel a little uncomfortable taking photos of ads they see or engaging in focus groups. Although the researchers will take every precaution to maintain confidentiality of the data, the nature of focus groups prevents the researchers from guaranteeing confidentiality. It is possible that some focus group members may repeat things said in the meeting. The researchers will ask participants to respect the privacy of fellow participants and treat all information shared with the group as confidential.

6. What are the possible benefits of participating in this study?

A potential benefit from participating in this research project and the most important is that youth have a voice on a topic that affects them. We hope that the information gotten from this study can be used in advocating for policies restricting unhealthy food marketing to children in Newfoundland and Canada as a whole. As a gesture of gratitude, at the end of this study, we are providing all participants who consent and are selected for this study with \$30 e-gift cards, regardless of whether they complete all study activities.

7. If I decide to let my child take part in this study, can they stop later?

Participation is voluntary and either you or your child can choose to end your child's participation in the study at any time. The study team may ask why the child is withdrawing for reporting purposes, but you or your child do not need to give a reason to withdraw from the study if you do not want to. If either you or your child chooses to end your child's

participation after data collection has ended, your child's data can be removed from the study up to one month after completing the mobile diary. After this period, the data would have been de-identified and combined with other participants' data, and we will be unable to identify your child's data. If your child chooses to participate in the focus group, their responses cannot be removed as all responses are recorded as a collective group.

8. What are my rights when allowing my child participate in a research study?

You and your child have the right to receive all information that could help you make a decision about letting your child participate in this study, in a timely manner. You and your child also have the right to ask questions about this study at any time and to have them answered to your satisfaction.

Your rights to privacy are legally protected by federal and provincial laws that require safeguards to ensure that your privacy is respected.

Signing this form gives us your consent for your child to be in this study. It tells us that you understand the information about the research study. When you sign this form, you do not give up any of your legal rights against the researcher, sponsor or involved institutions for compensation, nor does this form relieve the researcher, sponsor or their agents of their legal and professional responsibilities.

You have the right to be informed of the results of this study once the entire study is complete. The results of this study will be submitted to a peer-reviewed journal for publication and a copy of the article will be provided to you if you are interested.

9. What about my child's privacy and confidentiality?

The data for the first part of this study is collected using the Catalyst by MetricWire mobile application. The data captured by your child is synced to MetricWire's HIPAA-Compliant servers and it is encrypted during transmission from the mobile phone to the servers. If you or your child decides to discontinue the study, you can request for your data to be destroyed. You can contact MetricWire via email on brian.stewart@metricwire.com or by phone call on (519) 444-4834 (postal address: 151 Charles Street West, Suite 100, Kitchener, Ontario, N2G 1H6).

We will be assigning participants to focus groups based on their age and we will be collecting this information in the demographic survey that follows, if you consent to this study. The demographic survey also contains a question about your household income.

We take your child's privacy very seriously and will keep their information strictly confidential. We will never share personal information with any third party. MetricWire will also never access, use or share your data except we require it for your participation. Internet protocol (IP) addresses may be recorded by the software programs used for this study, but this information will not be used by the researchers or the owners of the programs with an intention to identify participants. We will delete your data from MetricWire's servers immediately after it has been transferred to the research team. You or your child should also delete the MetricWire app after the three-day mobile diary entries have been completed. To do this, touch and hold the app icon on your smartphone's homepage and select Delete, Delete App or Uninstall.

All data collected during this study will be stored for 5 years on an encrypted disk drive at Memorial University. Once data collection is completed and data analysis is finalized, a de-identified (all your identifying information removed) database will be archived and stored on password-protected computers at Memorial University and will only be accessible to other researchers for new research projects provided each of those projects is first submitted to the Health Research Ethics Board for ethical review and subsequently receives full approval.

10. Who will see my personal information?

Representatives from the Health Research Ethics Board may come to look at the study records and any personal information you have provided to check that the information collected for the study is correct and to make sure the study followed the required laws and guidelines.

11. Declaration of financial interest

A conflict of interest can occur when a person or group has more than one interest. In research, the people who run or work on studies must tell you if they have a conflict of interest. There are no conflicts of interest to declare related to this study.

12. What about questions or problems?

The final decision about participation in our study is yours. If you have any questions about this project, please contact me on 709-725-4440 or by email at iobamigbayan@mun.ca. You can also contact my supervisor, Dr. Rachel Prowse at rprose@mun.ca.

If you have ethical concerns about the research, such as your rights as a participant, you may contact the Health Research Ethics Board at 709-777-6974 or info@hrea.ca.

Signature Page for Parent/Guardian

My signature on this consent form means:

- I have had enough time to think about the information provided and ask for advice if needed.
- All of my questions have been answered and I understand the information within this consent form.
- I understand that my child/ward's participation in this study is voluntary.
- I understand that if my child participates in the focus group, their responses will be audio-taped and if virtually, audiotaped and video-taped.

- I understand that I am completely free at any time to refuse for my child/ward to participate or to withdraw from this study at any time, without having to give a reason
- I understand that it is my choice for my child/ward to be in the study and there is no guarantee that this study will provide any benefits to me.
- I am aware of the risks of my child/ward participating in this study.
- I do not give up any of my child/ward's legal rights by signing this consent form.
- I understand that all of the information collected will be kept confidential and that the results will only be used for the purposes described in this consent form.

Would you be willing to allow your child to participate in this study?

By clicking "Yes" below, you confirm that you are the parent/legal guardian of the child participating in this study and agree to allow them to participate.

- Yes
- No

I consent for my child/ward _____ to take part in this study.

Type your full name

Date

If "Yes" demographic survey will show up and then send an email/text invite with a link to the study, if "No," present the participant with the closing message: "Thank you for your time."

Child Consent

Before you start, please read this letter and let us know if you agree to participate.

- The study will involve downloading a mobile app and taking photos of food ads that you see for a period of 3 days. You will then upload these photos and tell us about the ad. You will complete a feedback survey at the end of the third day and also engage in one focus group discussion.
- You must be between 13 and 17 years of age to participate.
- The study is led by Idris Bamigbayan and Dr. Rachel Prowse of Memorial University of Newfoundland, Canada.
- As a thank you for participating, a \$30 e-gift card will be sent to the email address provided by your parent or guardian regardless of whether you complete all the study activities.
- You do not have to participate and even if you decide to, you can choose to stop participating at any time. As far as we know, being in this study will not hurt you in anyway.
- We take your privacy very seriously and will keep your identity confidential. Only the study researchers will see your entries. The data you provide will be encrypted and is therefore protected. Your information will be kept for 5 years in a secure location at Memorial University.
- If you have ethical concerns about the research, such as your rights as a participant, you may contact the Health Research Ethics Board at 709-777-6974 or info@hrea.ca.
- The final decision about participation in our study is yours. If you have any questions about this project, please contact me by email at iobamigbayan@mun.ca or Dr. Rachel Prowse at rprowse@mun.ca

Do you agree to participate in this study?

- Yes
- No

This consent form will be included in the mobile app and participants will be unable to use the app until they consent to participating in the study.

Appendix H: Food Marketing Indicators and Descriptions.[169]

Marketing platform/setting	Indicator	Description
UNIVERSAL INDICATORS (All media and settings)	Presence of children	Food/Beverage (F/B) ad features children (12 years and younger)
	Presence of teens	F/B ad features teens (13-17 years)
	Adult-child situations	F/B ad features situations that play on the parent-child relationship or other authority-based relationship (e.g., coach-child, teacher-child)
	Adult-teen situations	F/B ad features situations that play on the parent-teen relationship or other authority-based relationship (e.g., coach-teen, teacher-teen)
	Use of child language	F/B ad uses language that is associated with children, that is frequently used by children or that is directed at children
	Use of teen language	F/B ad uses language that is associated with teens, that is frequently used by teens or that is directed at teens
	Child themes/visual design	F/B ad uses themes, designs, colours, images, or other elements of audiovisual design that are commonly associated with children such as fantasy, magic, mystery, suspense, adventure, zoo animals, virtual worlds, etc. This could include references to, or the incorporation of, popular trends in children's interests or preferences, which may vary year-to-year or based on geographic location. <i>Note: this could refer to theme/design of the marketing instance (e.g., the side of a vending machine) or of the product itself (e.g., the packaging)</i>
	Teen themes/visual design	F/B ad uses themes, designs, colours, images or other elements of audiovisual design that are commonly associated with teens such as themes linked to high school, social media, 'hanging-out', popularity, fashion, risk-taking, independence, etc. This could include references to, or the incorporation of, popular trends in teen's interests or preferences, which may vary year-to-year or based on geographic location. <i>Note: this could refer to theme/design of the marketing instance (e.g., the side of a vending machine) or of the product itself (e.g., the packaging)</i>
	Unusual product appearance	The F/B ad depicts a product's shape or colour that is unconventional or unusual for that type of product. For example, if crackers or pasta have a shape other than their usual square or round shape or are multi-colored rather than their usual plain/brown colour. This may include if the package itself is shaped in a fun, interesting or unconventional way.
Unusual product flavour	The F/B ad promotes a product flavour that is unconventional or unusual for that type of product, or a flavour that is not a 'real' or 'discernable' flavour. <i>Note: this could include the presentation of the flavour in a 'negative' way that may appeal to youth (e.g., tastes crazy, weird, sour, whacky)</i>	

Appeals to fun/cool	Ad makes appeals to the F/B being fun or funny, having fun while eating the product, humour or coolness/novelty. This could include depictions of the food itself doing something fun, or depictions of the food in motion (e.g., a cookie diving into milk, or candies ‘exploding’ out of ice cream). <i>Note: this this could be as part of the product name (e.g., “Fun Dip”, “Kool Kreatures”)</i> <i>Note 2: there could be potential for overlap with other indicators, avoid double counting a single feature in the ad</i>
Branded characters	F/B ad features company- or brand-owned characters or spokespersons. This could also include mascots of these characters. <i>Note: these characters are often given a name and are used across marketing platforms</i>
Licensed characters	F/B ad features licensed characters from children’s and teens’ TV shows, movies, books, etc.
Other cartoon characters	F/B ad features generic cartoon characters, cartoon children/teens, animals, or imaginary/virtual creatures etc. that are not branded or licensed characters, celebrities, or cross-promotions to other media
Celebrities/public figures	F/B ad features actors, athletes, musicians, social media influencers, or other public figures
Cross-promotions	F/B ad features cross-promotions to movies/sports/TV show etc. other than one of the types of characters or celebrities described above. For example, the ad features aspects of a well-known fictional world, without specifically including the fictional characters. <i>Note: these may appear in addition to the presence of any characters described above</i> <i>Note 2: this includes sound effects in the ad that are clearly from movies or media</i>
Games or activities	Presence of games or activities on the advertisement (including on packaging, marketing display, etc.)
Price promotions, incentives or giveaways	F/B is included as part of a price-promotion or premium, including discounted prices on other merchandise included with the purchase of a food or beverage product. Ad promotes contests, prizes, or giveaways available with or without purchase.
Calls-to-action	F/B ad encourages consumers to buy the product, participate in a campaign, visit a product/brand/company website, social media or games-based brand websites (including via QR code). Also includes the promotion of opportunities to “join”, “become a member”, complete a quiz, poll, or survey
Appeals to health or nutrition	F/B marketing makes explicit appeals related to the healthfulness or nutritional quality of the product, its ability to promote wellness, growth, strength, or physical activity. This indicator also includes if the marketing makes implicit appeals to health or nutrition, such as the F/B being displayed alongside “healthy foods” (e.g., fresh fruit being depicted in an ad for

		breakfast cereal), or the F/B being shown consumed by children while participating in physical activity. <i>Note: includes health and nutrition claims/symbols, as well as claims or symbols making reference to the product being organic or natural. This indicator is distinct from the packaging indicator below.</i>
	Promotion of product convenience	Specific promotion of the product being convenient for snacking, packing in lunches, eating after sports practice, quickness, easy preparation, etc. <i>Note: this does not include single-serve packaging (e.g., juice boxes or crackers and cheese packs) without specific promotion of their convenience</i>
	Displays of corporate social responsibility	F/B marketing makes appeals to sustainability, philanthropy or contributing to other social causes
Specific indicators for food retail settings	Endcap display	F/B is promoted/displayed at the endcap of the grocery aisle in a highly visible way <i>Note: this includes if any island display is pushed right next to the end of an aisle</i>
	Island display	F/B is promoted/displayed on a temporary and movable display. This can include tables with items on it, cardboard or wire shelf displays, bins or stacks of products in the aisles, and so forth. <i>Note: these do not include the permanent islands used for the bakery and fruit and vegetable section. Sometimes temporary displays are pushed in front of the checkout area these should be considered islands, not as a part of the checkout.</i>
	Checkout display	F/B is promoted/displayed at the cash register or checkout aisle
Specific indicators for restaurant settings	Children’s menu	F/B is featured on a menu specifically designated for children
	Children’s activity	F/B is featured on a children’s activity sheet or other children’s materials provided at a restaurant
	Value menu	F/B is featured on the “dollar” or value menu
	Seasonal or limited time menu	F/B is featured as part of a seasonal, holiday-specific, or limited time promotion menu
Specific indicators for community settings	Branded infrastructure, displays, furniture	Presence of infrastructure, displays or furniture that are clearly associated with a F/B brand, either by way of shape, size, or appearance. This could include branded tents, flags, posters, kiosks, trucks, trash cans, scoreboards, bleachers, etc.
	Branded clothing, objects, equipment	Presence of clothing, objects that are clearly associated with a F/B brand, either by way of shape, size, or appearance. This could include sports jerseys, equipment, balls, medals, trophies, water bottles, etc
Specific indicators for product packaging	Government-regulated health and nutrition claims/symbols	F/B package displays a government regulated health or nutrition claim (https://www.canada.ca/en/health-canada/services/understanding-food-labels/nutrition-claims.html) <i>Note: this indicator replaces “appeals to health/nutrition” (above) to add more nuance for evaluations of marketing on packaging</i>
	Other appeals to health or nutrition	F/B package makes appeals to the healthfulness or nutritional quality of the product, its ability to promote

		growth, strength, or physical activity using claims or symbols that are not government-regulated. <i>Note: this indicator replaces “appeals to health/nutrition” (above) to add more nuance for evaluations of marketing on packaging</i>
Specific indicators for television	Child themes	F/B ad uses a setting, storytelling themes, or context that are commonly associated with children such as fantasy, magic, mystery, suspense, adventure, zoo animals, virtual worlds, etc. This could include references to, or the incorporation of, popular trends in children’s interests or preferences, which may vary year-to-year or based on geographic location. This indicator applies primarily to video-based content. <i>Note: for the television and digital settings, the indicators for child themes and visual design are split up to reflect the interactive nature of the medium</i>
	Child visual design	F/B ad uses designs, colours, images or other elements of audiovisual design that are commonly associated with children. This could include references to, or the incorporation of, popular trends in children’s interests or preferences, which may vary year-to-year or based on geographic location. <i>Note: for the television and digital settings, the indicators for child themes and visual design are split up to reflect the interactive nature of the medium</i>
	Teen themes	F/B ad uses a setting, storytelling themes, or context that are commonly associated with teens such as such as themes linked to high school, social media, ‘hanging-out’, popularity, fashion, risk-taking, independence, etc. This could include references to, or the incorporation of, popular trends in teen’s interests or preferences, which may vary year-to-year or based on geographic location. This indicator applies primarily to video-based content. <i>Note: for the television and digital settings, the indicators for teen themes and visual design are split up to reflect the interactive nature of the medium</i>
	Teen visual design	F/B ad uses designs, colours, images, or other elements of audiovisual design that are commonly associated with teens. This could include references to, or the incorporation of, popular trends in teen’s interests or preferences, which may vary year-to-year or based on geographic location. <i>Note: for the television and digital settings, the indicators for teen themes and visual design are split up to reflect the interactive nature of the medium</i>
	Special effects	F/B ad features special effects, fast-cutting or animation
	Children’s songs or music	F/B ad features songs, music, jingles, or other audio that are child-like, such as with child voices, kids playing music, story-telling songs, lullabies, etc.
Specific indicators for digital media	Advergames	F/B is featured in an advergame
	Advercation	F/B featured within online child/youth educational content
	Special effects	F/B ad features special effects, fast-cutting or animation

	Children's songs or music	F/B ad features songs, music, jingles, or other audio that are child-like, such as with child voices, kids playing music, story-telling songs, lullabies, etc.
	Viral marketing	F/B ad prompts viewers to engage with the brand by commenting, replying, sharing information with their peers (peer-to-peer marketing), re-posting content to their own feeds, tagging friends or using specific hashtags.