

**Exposure and Perceptions of Caffeinated Energy Drink Marketing
among Youth and Young Adults in Canada**

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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ABSTRACT

BACKGROUND: Consumption of caffeinated energy drinks (CEDs) has become increasingly prevalent among youth and young adults, which is concerning given the association with adverse health effects and other risky behaviours. Health Canada does not recommend consumption of CEDs for use during sports, with alcohol, as well as by children. Accordingly, beverage companies must comply with regulations surrounding advertising and claims related to CEDs. There are several evidence gaps related to CED marketing: To date, very little research has been conducted on advertising exposure and perceptions, and no research has examined exposure to educational messages that warn about potential health risk of energy drinks. The current study had two primary objectives: 1) to evaluate exposure to energy drink marketing and educational messages that warn about the potential health risks of energy drinks; and 2) to examine perceptions of CED ads in association with sports and alcohol use, as well as target age groups.

METHODS: An online survey was conducted in 2015 with youth and young adults aged 12-24 years recruited from a national commercial online panel, consisting of two sub-studies. In Study 1, participants (n=2,023) were asked about their exposure to energy drink marketing via ten channels, and to educational messages that warn about the potential health risks of energy drinks. Regression models (negative binomial and logistic) examined correlates of exposure to marketing and educational messages. In Study 2, participants (n=2,010) completed three experiments in which they were randomized to view different CED advertisements for leading brands: 1) sports/party-themed ads, 2) sports-themed ad, and 3) party-themed ad, vs. control 'product information' ads for the same brands. For each ad, participants were asked about the perceived target age group, and if the ad promoted use of CEDs during sports and with alcohol. Logistic regression models were fitted to test for differences in outcomes between experimental conditions. Two-way interactions were also tested.

RESULTS: In Study 1, over 80% of respondents reported ever seeing energy drink marketing through at least one channel, most commonly television (58.8%), posters or signs in a

convenience or grocery store (48.5%), and online ads (45.7%). Respondents reported a mean of 3.4 marketing channels (SD=2.9) out of ten. Respondents aged 18-19 (vs. 12-14 and 15-17) and 20-24 (vs. 12-14 and 15-17) reported significantly more channels of exposure to marketing. Overall, 32% of respondents reporting ever seeing an educational message about energy drinks. The most frequently reported sources of exposure were at school (16.2%), online (15.0%), and on television (12.6%). Respondents aged 18-19 (vs. 12-14, 15-17 and 20-24) and 20-24 (vs. 15-17) were significantly more likely to report having seen an educational message.

In Study 2, the majority of respondents reported that the energy drink ads across all themes targeted people their age. In experiment 1, both sports/party-themed ads were more likely to be perceived as promoting use of CEDs during sports (AOR=13.32; 95% CI 9.90, 17.91, and AOR=9.73; 95% CI 7.38, 12.81, respectively), and with alcohol (AOR=8.55; 95% CI 6.37, 11.48, and AOR=2.81; 95% CI 2.08, 3.78), compared to the control ad. There were also significant interactions between condition and sex ($X^2=7.9$, $p=0.02$), and condition and exposure to energy drink marketing channels ($X^2=124.3$, $p<0.001$) in perceiving the ad as promoting use of CEDs during sports. In addition, there were significant interactions between condition and sex ($X^2=7.2$, $p=0.03$), and condition and age group ($X^2=20.2$, $p=0.003$) in perceiving the ad as promoting use of CEDs with alcohol. In experiment 2, the sports-themed ad was more likely to be perceived as promoting use of CEDs during sports (AOR=15.02; 95% CI 11.83, 19.08), but not with alcohol, compared to the control ad. There were also significant interactions between condition and sex ($X^2=12.8$, $p<0.001$), condition and age group ($X^2=17.8$, $p<0.001$), and condition and exposure to energy drink marketing channels ($X^2=13.4$, $p<0.001$) in perceiving the ad as promoting use of CEDs during sports. In experiment 3, the party-themed ad was more likely to be perceived as promoting use of CEDs with alcohol (AOR=13.79; 95% CI 10.69, 17.78), but not during sports, compared to the control ad. There was also a significant interaction between condition and sex ($X^2=8.0$, $p=0.005$) in perceiving the ad as promoting use of CEDs with alcohol.

CONCLUSIONS: Exposure to energy drink marketing was common among youth and young adults and was significantly more prevalent than exposure to educational messages that warn about the potential health risks of energy drinks. In addition, ads from leading energy drink brands are perceived as targeting young people and encouraging energy drink use during sports and with alcohol, despite Canadian regulations prohibiting these marketing practices.

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LIST OF ABBREVIATIONS

AAPOR	American Association for Public Opinion Research
AmEDs	Alcohol mixed with energy drinks
BMI	Body mass index
CED	Caffeinated energy drink
GPA	Grade point average
IARC	International Agency for Research on Cancer
ORE	Office of Research Ethics
SAS	Statistical Analysis System
SES	Socioeconomic status
SPSS	Statistical Package for the Social Sciences
TMA	Temporary Marketing Authorization

BACKGROUND

ENERGY DRINKS

Caffeinated energy drinks (CEDs) are beverages that contain high levels of caffeine, often in combination with other ingredients.¹ CEDs were first introduced in Europe and Asia in the 1960's; however, the introduction of *Red Bull* in Austria in 1987 and the U.S. in 1997 initiated huge market growth including a rise in products, marketing, and popularity of CEDs.² CEDs are now the fastest growing sectors of the beverage market.²⁻⁴ In Canada, CEDs have no particular standard of identity, meaning that the ingredient profile may vary in type and quantity beverage to beverage.¹

Ingredient profile

While caffeine is the main active ingredient in CEDs, there are many other ingredients that are often added to CEDs including taurine, glucuronolactone, B vitamins, guarana, yerba mate, and ginseng. Although many brands share a similar ingredient profile, brands may vary in ingredients or combinations used. While extensive research has been conducted on caffeine, there is less known about the other constituents of CEDs.

Potential physical and cognitive aid of ingredients

Caffeine can act as a physical and cognitive aid.⁵ The main mechanism of caffeine is to bind to adenosine receptors. Adenosine is a molecule involved with many biochemical pathways promoting sleep, as well as affecting memory and learning.⁴ When caffeine binds to adenosine receptors, neurons speed up, and the central nervous system becomes stimulated.³ Salivary levels of caffeine peak about 45 minutes after consuming caffeine and the half-life of caffeine is 3-7 hours in adults; the half-life of caffeine is much longer in children, as well as pregnant women, meaning the effects of caffeine will last longer.⁴

It has been found that caffeine can enhance a variety of physical activities, including high intensity, muscle strength and endurance.^{6,7} Caffeine also increases alertness and wakefulness, improves performance on memory tasks, improves psychomotor vigilance, and has also been

used to treat pain.⁴ However, an increase in mental alertness caused by caffeine consumption in regular users is also due to reversal of withdrawal symptoms.⁸

Consuming CEDs is associated with an improvement in physical activity performance in a wide variety of sports including basketball, cycling, tennis, and volleyball.^{9–12} A recent meta-analysis looking at the effects of caffeine-containing energy drinks on physical performance found that although consuming CEDs improved performance, caffeine dosage was not associated with improved performance meaning that even low doses had a positive effect on performance; rather, it was found that the dosage of taurine, another ingredient often found in CEDs, had a significant positive effect on physical performance.¹³ This idea that other functional ingredients in CEDs may also play a role in improved performance is also supported by another study that found that consumption of CEDs improved cycling endurance performance, despite caffeine dosage being at the lower end of about 2.35mg/kg.¹⁴

Taurine is a non-essential amino acid. The maximum level of taurine permitted in an energy drink serving is 3000mg. As some previous studies have looked at the performance effects of taurine with other active ingredients such as caffeine, as it is most typically ingested, it is difficult to isolate independent or interactive effects of taurine on performance. Studies looking at taurine supplementation alone have found mixed evidence of performance enhancing properties.^{15–19} However, as stated previously, a recent meta-analysis found that taurine dosage in CEDs, rather than caffeine dosage, was associated with improvements in performance.¹³ It has been suggested that taurine may increase calcium regulation, which in turn may allow for excitation-contraction of skeletal muscles.¹³

Although many brands offer sugar-free versions, sugar is often an ingredient in CEDs.³ In Red Bull, for example, sugar is added in quantities of 11g/100mL, meaning that a 250mL can would have 27.5g of sugar. In regards to sugar found in CEDs improving cognitive and physical performance, it was found that Red Bull provided improvements in accuracy and speed of memory tests over both the sugar free version, and placebo.²⁰ However, these improvements in

memory may be due to an interaction between glucose and other ingredients found in energy drinks, rather than glucose alone.²⁰ Carbohydrate consumption before and during physical activity has also been found to improve performance in athletes.^{21,22} However, energy drinks also contribute to added sugar intake among young people, which is associated with excess weight gain.²³ Glucuronolactone, a metabolite formed from sugar in the liver, is another ingredient often added to CEDs. There is no evidence of any physical or cognitive benefit of adding glucuronolactone to CEDs.⁵

B vitamins are also commonly added to CEDs in high amounts. B vitamins are involved with basic cellular processes and are water soluble, meaning that once the recommended dietary allowance has been met, any excess is excreted out of the body. There is limited rationale for adding B vitamins in such large quantities to CEDs, and there is also no evidence that the addition of B vitamins will improve physical or cognitive performance.⁵

Guarana is a plant that originates from Brazil. Guarana produces a fruit with seeds containing caffeine. Approximately 1g of guarana is equal to 40mg of caffeine.³ Some studies have found that guarana improves cognitive performance, but it is unknown whether guarana improves physical performance.^{3,21} Although the active ingredient in guarana is caffeine, it has been questioned whether the improvement in cognitive performance is due to the caffeine in guarana, as the guarana intake in these studies have translated to very little caffeine intake. However, alternative explanations have yet to be explored.²¹

Yerba mate is a plant that originates from South America and it is commonly consumed as tea. Yerba mate has a high caffeine content with about one cup of yerba mate being equivalent to 78mg of caffeine.³ Yerba mate is thought to have health benefits such as antioxidants, weight management, and cancer prevention, although the plant may also cause certain types of cancers.²⁴ Aside from the caffeine content in yerba mate, there is no evidence that the other components of the plant improve performance.⁵

Ginseng is a herbal supplement that has increased in popularity over recent years and is often added to CEDs.³ It has been used by people in East Asian countries to promote health and to help with disease. There is mixed evidence of the effectiveness of ginseng for both health as well as for the purpose of increasing physical or cognitive function. There are some studies that have found that ginseng has the potential to improve some aspects of cognitive performance, including memory.²¹ There is limited research on the effects of ginseng on physical performance, however one study found that that ingesting ginseng improved motor skills.²¹ More research is needed to conclude upon the physical and cognitive effects of ginseng.

Though several studies support the idea that CEDs may be beneficial in improving some aspects of physical and cognitive performance, most likely due to caffeine, or other caffeine containing ingredients, there is a vast amount of research pointing to the potential harms associated with the consumption of CEDs. Further, while much is known about caffeine, less is known about other ingredients found in CEDs, including both their individual effects, as well as interactive effects.

HEALTH EFFECTS

Adverse health effects have been associated with CED consumption. Most risk assessments of CEDs conducted to date have modelled the risks of CEDs based on the caffeine content, particularly with respect to coffee consumption. Caffeine intake in quantities found in most CEDs has been commonly associated with insomnia, nervousness, headache, and fast heartbeat.^{25,26} In very high doses, caffeine can also cause abdominal pain, vomiting, hypokalemia, hallucinations, cerebral edema, stroke, paralysis, seizures, arrhythmias, and death.²⁶ Caffeine is also a diuretic, which increases the risk for dehydration.²⁵ However, moderate consumption of coffee (three to four cups per day providing less than the recommended limit of 400mg caffeine) is associated with minimal risks and may incur health benefits including helping prevent several chronic diseases including type 2 diabetes and liver disease.²⁷ For example, a recent multinational cohort study found that coffee consumers had statistically significant lower all-cause mortality.²⁸

Consumption of CEDs by young people is particularly concerning. Due to lower body weight, recommended caffeine intake is significantly lower among this age group. Younger people are therefore at a higher risk for adverse health effects associated with energy drink consumption.²⁶ Furthermore, young people who are not habitual users have a much higher risk of caffeine intoxication due to low tolerance for caffeine.⁸ Adverse health effects are particularly concerning with the consumption of energy shots, in which consumers can consume a large amount of caffeine from a container with a volume much less than that of an energy drink (90mL or less). Energy shots have been associated with a similar number of adverse events as energy drinks, many being very serious or life-threatening.²⁹ The number of emergency visits related to CEDs have increased heavily over the years, with evidence from the U.S. that CED-related emergency department visits doubled from 2007 to 2011.^{30,31} Further, over half of youth and young adults in Canada who have ever used CEDs have experienced an adverse event, including fast heartbeat, difficulty sleeping, headaches, nausea/vomiting/diarrhea, chest pain, and seizures.³²

CED consumption by young people has been associated with a variety of health damaging behaviours and experiences. While these negative behaviours and experiences may be caused by the consumptions of CEDs, it is very likely that that the type of person who is consuming them is more likely to engage in other risky and damaging health behaviours. The setting in which CEDs are consumed may also provide an explanation as to why CED consumers are more likely to engage in other risky behaviours. It is most likely a combination of the product, the person, and the setting that is able to explain the association between CED consumption and other health damaging behaviours and experiences. For example, consumption of CEDs by children and young people has been associated with alcohol use and binge drinking, smoking, and other substance use,^{33,34} as well as negative health behaviors including problems with behavioral regulation and metacognitive skills, self-harming behaviours, sensation seeking, and poor lifestyle behaviours including poor dietary choices.³⁴ In addition, the consumption of CEDs has also been linked to symptoms of mental health problems including depressive symptoms,

emotional difficulties and lower subjective well-being,^{35,36} in which dysregulated sleep may be an important moderator.³⁷ CED consumption is associated with reduced sleep quality, later bed times, and poorer sleep patterns.³⁸ One recent study found that adolescents who were regular users of CEDs were more likely to have negative school experiences and problem behaviours, such as disliking school and being more likely to fight, bully others, skip school lessons and have low academic achievement.³⁹ Past-week adolescent CED consumers were more likely to consume fried and high-sugar foods than those who were not past week CED users,⁴⁰ and were also more likely to have a slightly higher BMI.⁴¹ CED consumption also contributes to extra energy, and poses a contributing risk factor for dental caries and obesity.²⁵

The adverse health effects from CEDs are significantly more common than the adverse health effects from other sources of caffeine, such as coffee.³² The greater risks of adverse events from CEDs compared to coffee may be due to other stimulants found in these beverages, although this is not well understood. Alternatively, the greater risks may be due to the context in which CEDs are consumed, including by younger consumers, but also during periods of physical activity and alcohol use, as described below.

Health effects if consumed during sports

Health Canada does not recommend the consumption of CEDs within the context of sport performance, especially for hydration purposes, and for novice users who have had little prior exposure to caffeine.^{1,42} While there is evidence that the ingredients found in CEDs have the potential to improve physical performance, there are potential adverse health effects that should be considered. The consumption of CEDs before or during training can cause restlessness and irritability, increase blood pressure, reduce insulin sensitivity, and may result in dehydration.^{43,44} Case studies have found that consuming an excessive amount of CEDs before physical activity can cause cardiac arrest and even death.^{45,46} Due to potentially dangerous outcomes, energy beverages are not recommended for those participating in exercise,⁴³ especially children and adolescents.⁴⁷ A recent review on the safety of ingested caffeine identified that more research needs to be conducted to better understand the dangers of

consuming energy drinks before, during, or after physical activity, in order to address the dangers in energy drink marketing claims.⁴

Health effects if consumed with alcohol

Health Canada does not recommend consuming alcohol mixed with energy drinks (AmEDs).¹ Despite cautionary labelling on CED packaging advising 'Do not mix with alcohol', this practice has become increasingly popular especially by youth and young adults.⁴⁸ There are many health risks associated with mixing CEDs with alcohol. One recent study found that when mixing alcohol with CEDs, there was a greater odds of most stimulant side effects such as heart palpitation, heart racing, and insomnia, and lower odds of sedation side effects such as nausea, dizziness, and fatigue, than when consuming alcohol alone.⁴⁹ Potential health risks of mixing the two products include reduced feelings of impairment and masking of drowsiness associated with alcohol intake, which may increase the risk for dehydration, overconsumption of alcohol, and alcohol-related injury.⁴⁸ Importantly, while the subjective perception of alcohol impairment may be less when alcohol is mixed with energy drinks, the effect does not lessen objective measures of alcohol impairment and breath alcohol concentration.⁵⁰

A recent study found that young adults who consumed AmEDs reported more alcohol related problems, alcohol use disorder, and binge drinking, than those who used energy drinks without concurrent alcohol, or non-energy alcohol users.⁵¹ Further, the consumption of AmEDs is also associated with a wide range of risky behaviors including a greater likelihood of driving while intoxicated or getting into a car with an intoxicated driver, as well as being hurt or injured.⁵² Recent findings from a systematic review support the association between AmED use and risk of injury.⁵³ Other behaviors associated with consumption of AmEDs include using drugs, engaging in risky sexual behaviour, and physical aggression.⁵⁴ In alcohol-related bar conflicts, AmED users had higher levels of verbal and physical aggression than alcohol users only, after controlling for a wide range of factors such as sensation seeking and aggressive personality traits.⁵⁵

Although there are health risks associated with the consumption of alcohol alone, the risks associated with AmEDs are further pronounced.^{56,57} There is also evidence that AmEDs increases the desire or craving to consume more alcohol.^{58,59} Findings from a systematic review and meta-analysis found that AmED consumers consumed more alcohol than alcohol-only users in a single drinking episode; however, within-subject comparisons revealed no significant difference in alcohol consumption between AmEDs and alcohol only occasions suggesting phenotype differences between the type of consumer.⁶⁰ Another study found that participants consumed AmEDs at a significantly faster rate than alcohol alone.⁶¹ Furthermore, AmEDs are commonly consumed before a main drinking event to provide energy for the evening.^{62,63} It has also been proposed that consuming AmEDs may be a marker of heavier drinking.⁶⁴

Following the recent death of a 14-year-old girl who had consumed an alcoholic beverage containing natural caffeine, Health Canada issued a reminder about safe levels of alcohol consumption, as well as advice not to mix alcohol with energy drinks.⁴⁸ While current regulations prohibit adding caffeine to alcoholic beverages, a 'loophole' exists in which flavouring agents, including natural sources of caffeine such as guarana or coffee, may be added to alcoholic beverages.⁶⁵

PREVALENCE OF CONSUMPTION

CED consumption is most common among youth and young adults. Almost 75% of young people in Canada have tried CEDs at least once in their lifetime,⁶⁶ with past year consumption ranging from 38% up to 68%.⁶⁷⁻⁷⁰ Past week consumption ranges from 15% to 20%.^{66,68,69} In terms of daily consumption, while most respondents (12-24 years) consumed a maximum of one CED or less per day, 24.9% consumed a maximum of two per day, 9.0% consumed a maximum of three per day, and 6.9% consumed a maximum of four or more per day, with older respondents (18-24 years) being more likely to have exceeded two or more per day.⁶⁹ Of ever-consumers, the mean age that respondents first tried one was 15 years.⁶⁹ Many factors are associated with past use of CEDs. Past consumption of CEDs has been shown to be more prominent among males, those who identified as Aboriginal, those with some spending money,

those with BMI categories other than in the healthy range, those who were are trying to lose weight, those with a greater intensity of alcohol use,⁶⁹ those with negative health states (heightened sensation seeking, elevated depressive symptoms) and those who participate in other risky behaviors (tobacco, alcohol, marijuana, and other drug use).^{67,68} There is mixed evidence on age as a predictive factor of CED use. While there is evidence of CED consumption being more likely among younger users (those in grades 7-9), and decreasing with age,^{67,71} there is also evidence of a greater likelihood of CED use among those in senior grades in comparison to junior grades.⁷⁰ One study also found CED consumption to increase with age among males, while use among females was shown to be highest in the youngest age groups (less than or equal to 13 years), decrease from there, and then increase again at 18 years.⁶⁹

Prevalence of consumption for use during sports

CED consumption is more common among athletes than non-athletes.⁷² For example, in a sample of Polish adolescents, it was found that while 67% of students reported consuming CEDs, those who played sports consumed CEDs more often (77%), compared to those who did not play sports (23%).⁷² Therefore, many studies have looked at consumption patterns and reasons for use among athlete populations and those who play sports. Studies have found that 13 to 16% of respondents reported consuming CEDs before physical effort and 5 to 13% of respondents reported consuming CEDs after physical effort.⁷²⁻⁷⁴ Estimates are much higher when looking at samples with CED users only, with one study finding that 41% of total adolescent energy drink users (53% of adolescent CED users practising sport) and 52% of total adult energy drink users (75% of adult CED users practising sport) reported consuming CEDs before, during, or after practising sport or physical activity.⁷⁵ Further, around 10 to 14% to as high as 80% of respondents who participated in sports reported an improvement in their athletic performance or that they used CEDs to improve their athletic performance.^{73,76-78}

In terms of frequency of use by athletes, it has been found that about 17% of athletes consume CEDs every day or one to three times a week⁷⁴ with one study providing evidence that 62% of athletes consume CEDs at least once a week.⁷⁸ Past month use has been found to range from

over one third to around 78% of respondents.^{73,74,79} Among athletes, males, those with low nutrition knowledge, and a lower GPA were more likely to be CED users.⁷⁶ A variety of reasons and motivations for consuming CEDs within the context of sports have been identified, including to increase endurance time at maximum intensity, power, vitality, concentration, and aerobic endurance.⁷⁵

Prevalence of consumption with alcohol

Consuming AmEDs is a common practice, especially among students. Studies have found that 17 to 45% of young people consumed AmEDs in the past year^{69,71,75,80,81} with ever-use ranging from similar levels to much higher.^{72-74,82-85} CED users have higher rates of AmED use, with evidence that 53% of adolescent CED users, and 56% of adult CED users (71% for ages 18-29) consumed AmEDs in the past year.⁷⁵ Studies have also shown that first time use of AmEDs is at a young age, with some respondents initiating use in elementary school.^{82,84} A range of factors are associated with the use of AmEDs, however there is mixed evidence for some correlates like gender and race. While some studies have found that being male^{74,80,82,84,86} and 'white'^{80,87} are associated with the use of AmEDs, others have found associations to neither or alternative associations.^{69,71,88} Other factors associated with the consumption of AmEDs include heavy drinking, substance use, participation in sports, and having more spending money.^{69,71,86} A variety of reasons for consuming AmEDs have been identified including to improve the taste of alcohol, to feel intoxicated, out of curiosity, to feel awake, to consume more alcohol, for social reasons, and to reduce the side effects of alcohol.⁸⁴

CED REGULATIONS

Regulations for CEDs vary by country. In Canada, CEDs transitioned from *natural health product* regulations to those of the *Food and Drugs Act* in 2012.¹ When CEDs transitioned to regulations under the *Food and Drugs Act*, they received a Temporary Marketing Authorization (TMA). Under a TMA, CEDs are allowed to be marketed under specific conditions, and manufacturers or distributors must collect data in order to inform Food and Drug Regulations. These regulations apply to products that are pre-packaged, ready-to-consume, water based

caffeinated beverages with 200-400 ppm (mg/L) of caffeine from all sources.¹ Any caffeinated products that are not consumed or perceived as foods remain classified as *natural health products*; such products include 'Energy shots' which have a maximum volume of 90mL.

Under the Food and Drugs Act, a single serving CED container cannot exceed 180mg of caffeine; multi-serving containers cannot exceed 180mg per serving (500mL).¹ A 250mL can of Red Bull contains 80mg of caffeine, while a 473mL can contains 151mg of caffeine. CEDs must include caffeine content on product labels, per single serving container, or per serving (500mL) in multi-serving containers.¹ Caffeine from all sources, whether synthetic or natural, must be included in the quantitative declaration. In addition, a caffeine statement of 'High caffeine content' or an equivalent synonym is required on the label.¹

In reference to caffeine recommendations by Health Canada, it has been proposed that for the average adult, up to 400mg/day of caffeine is not associated with adverse health effects.⁸⁹ Children aged 4 to 12 years of age are advised to have a maximum of 45mg/day for 4-6-year-olds, 62.5mg/day for 7-9-year-olds, and 85mg/day for 10-12-year-olds. For adolescents aged 13 and older, it is recommended to consume no more than 2.5mg/kg body weight. For women who are pregnant or who are planning on becoming pregnant, as well as breastfeeding mothers, it is recommended to consume no more than 300mg/day.⁸⁹

CEDs are not recommended for children, pregnant or breastfeeding women, and individuals sensitive to caffeine. Cautionary statements must be grouped together in bold text on the product: "Do not consume more than (X) container(s)/serving(s) daily" or "Usage: (X) container(s)/serving(s) maximum daily"; "Not recommended for children, pregnant or breastfeeding women and individuals sensitive to caffeine"; "Do not mix with alcohol".¹

Consumption recommendations depends on the ingredient profile and size of the specific CED. Daily maximum levels of vitamins, minerals, and amino acids outlined by Health Canada should be used to inform the maximum number of containers/servings in the cautionary statement, such that the maximum number of containers/servings does not result in the daily maximum

limit being exceeded.¹ Typically, the recommended maximum consumption of CEDs is two cans daily.

Alongside requirements for ingredients and labelling, CEDs must also comply with regulations on advertising and claims.¹ Under the Food and Drugs Act, the term ‘advertisement’ includes product representation by any means whatsoever that promotes the sale of the product, directly or indirectly.¹ Any information that is not allowed on labels is also not allowed in advertising. Therefore, as per the cautionary statement on the product, CEDs should not be promoted for use with alcohol and should not be promoted to children. In addition, the Canadian Beverage Association has voluntary marketing codes restricting the advertisement of CEDs in programming (TV, radio, print or digital) where 35% or more of the audience is under 12 years of age.^{90,91} Although not included as a cautionary statement on the product, health claims (implicit or explicit) promoting use of CEDs for physical performance (including physical exertion, endurance, aerobic, anaerobic, power, strength, motor performance, recovery, or sports) are prohibited.¹

CED MARKETING

Industry practices

Marketing of CEDs has risen dramatically in recent years, in line with consumption prevalence. In 2013, beverage companies spent \$175 million on advertising energy drinks in the U.S., comprising over 20% of the advertising expenditure for sugary drink and energy drink categories.⁹² Furthermore, energy drink advertising expenditure increased 250% from 2008 to 2012.⁹³ CED manufacturers typically target younger audiences and males, featuring athletes, extreme sports, popular entertainment, sponsoring events, and using promotions and attractive packaging.^{35,92,94,95} For example, Red Bull owns five sports teams and sponsors many athletes, which results in branded team names and brand logos appearing on equipment and attire that is worn by teams and athletes.^{95,96} Red Bull also has a significant involvement with eSports, hosting events and sponsoring players, which has essentially allowed the brand to become part of the eSports market. A popular eSports athlete and Twitch streamer, Ninja, who

is popular among young people, is sponsored by Red Bull and his video game streams advertise the product throughout. Marketing practices also include the use of sexual appeal through the use of models, which is another strategy to target males, and also may be promoting use of CEDs during partying and consequently consuming AmEDs.⁹⁷

One study looking at patterns of CED advertising over US television networks found that 5-hour energy, a manufacturer of energy shots, accounted for over 60% of total airtime for CED advertisements.⁹⁴ Among all age groups on TV, 5-hour energy was the most advertised brand of drinks.⁹² Of channels that devoted a lot of airtime for CED advertisements, 3 were music related, 3 were sports related, 2 were male related, and 2 were other related.⁹⁴ The channel that devoted the most time to CED advertisements (MTV2), had a 32% youth audience, and over half of the top 10 channels had adolescents as their primary target audience.⁹⁴ Evidence from South Africa has shown that the majority of advertising expenditure for CEDs has been on television advertising with a focus on sports and youth entertainment channels who have young male consumers.⁹⁸

Aside from television marketing, digital marketing is another area where CEDs are commonly advertised. There has also been a decrease in advertising on third-party websites, which appears to have been replaced by advertising on social media platforms, which are very popular among youth. Energy drinks have dominated social media marketing, with brands such as Red Bull, Monster Energy, and Rockstar being among the most active brands on all social media platforms.⁹² One Australian study on the content analysis of marketing techniques used by the 27 most popular Food and Beverage brand Facebook pages (three for energy drinks), found that these social media sites engaged in a variety of marketing techniques including competitions, prizes and giveaways, apps, and games.⁹⁹ For example, Red Bull's Facebook page had a variety of links to games that were based on motor sports that Red Bull sponsored.⁹⁹ It was also found that of all 27 most popular food and beverage brands, Monster Energy drink had the most active page in a one month page activity analysis, with 67 posts in one month, as well as the highest total number of 'likes' for its posts.⁹⁹ Further, recent Canadian research showed that

Red Bull Energy Drink is one of the top five most frequently advertised food and beverage products on children's and teen's favourite websites.¹⁰⁰ There is evidence that CED marketing is effective: one study found that exposure to digital marketing for the websites and social media sites of two popular brands of CEDs improved young adult participants' attitudes, as well as purchase and consumption intention of energy drinks.¹⁰¹

Exposure to CED marketing

Marketing impacts choices and behaviours, as shown in other domains, such as food marketing.^{100,102,103} Importantly, young people, particularly children, are vulnerable to marketing messages. While very young children do not understand the intent of ads, children around the age of 10-12 are typically able to recognize that the purpose of an ad is to sell a product, however, they are not always able to critically assess the ad.¹⁰⁰ Even teenagers are susceptible to marketing as they are likely to believe in industry tactics such as misleading claims.¹⁰⁰ Those who watch channels containing CED advertisements are significantly more likely to be consumers of CEDs.⁹⁸ In Canada, previous research found that over 80% of respondents aged 12-24 reported ever seeing a CED advertisement.¹⁰⁴ A recent qualitative study conducted on children and young people aged 10-14 in the United Kingdom found that respondents identified a wide variety of media through which they were targeted with CED promotional messages, including the internet, TV, computer games, bus stop adverts, supermarket promotion, and sponsorship of sports or other events.¹⁰⁵ A study on advertising exposure to sugar-sweetened beverages among US youth found that 42% of youth aged 12-17 reported seeing an energy drink ad 1 or more times per day, with highest exposure amongst those age 14-15, males, those whose parents had high-school education or less, and those who had a lower SES.¹⁰⁶

In the U.S., youth exposure to TV advertisements of energy drinks decreased between 2010 and 2013.⁹² Despite this decrease, sugary drink and energy drink exposure still contributed to about two thirds of all beverage ads seen by children in the U.S. For teens, energy drinks contributed to 23% and sugary drinks contributed to 20% of viewed drink ads. While number of visits to beverage company websites decreased by 60% from 2010 to 2013, visits to 5hourENERGY.com

and RedBullUSA.com increased by 20% or more.⁹² Many beverage websites, including six energy drink websites, had a significantly higher number of visits by teens compared to the internet overall.

Perceptions

There is very little evidence on how young people perceive content of energy drink advertisements. A qualitative study on perceptions and knowledge of CEDs among Canadian youth aged 12-18 found that respondents perceived CED marketing targeted their age group.¹⁰⁷ For example, the sponsorship of extreme sporting events was viewed as a way of targeting young people, in addition to package design which was perceived as appealing to teenagers. After participants viewed a sports-themed print advertisement for Red Bull, participants aged 12-15 believed the ads targeted their age or higher and believed the people in the viewed ad were aged 12-13 years old.¹⁰⁷ Participants were shown a second print ad including a DJ in a concert venue, in which participants viewed the ad as targeting older teenagers and young adults. In addition, respondents thought CEDs would be mixed with alcohol in the context of the ad.¹⁰⁷

Previous research on youth and young adults aged 12-24 in Canada found that most respondents reported that ads shown to them in the study were targeting people their age or younger.¹⁰⁴ This study also involved an experiment in which participants viewed one of four energy drinks ads, three of which were sports-themed. Results from this experiment showed that respondents were significantly more likely to believe an ad promoted CED use during sports if they viewed one of the three sports-themed ads, in comparison to the control ad.¹⁰⁴ Findings from this study clearly show that CED ads are perceived to be targeting young people and promoting consumption within the context of sports and physical activity.¹⁰⁴

Educational messages

To counteract unsafe consumption of CEDs and associated negative health effects, educational messages have been identified as a technique to communicate the health risks of CEDs. While

no previous studies have examined exposure or effectiveness of educational messages within the context of CEDs, the evidence on the effectiveness of educational messages is limited and variable. For example, while an educational poster aimed at reducing sugar sweetened beverage consumption reduced choice of sugar sweetened beverages, greater effects were seen when an educational poster was combined with price increases.¹⁰⁸ While educational messages have been shown to be very important in some domains, including reducing smoking prevalence,¹⁰⁹⁻¹¹¹ generally, successful behaviour change efforts involve multiple strategies.¹¹² The International Agency for Research on Cancer (IARC) conceptual framework can be used to understand how health warnings can ultimately impact behaviours.¹¹³ In this framework, health warnings affect salience and processing, impacting knowledge, brand appeal, affective reactions, and perceived risk. These general mediators impact avoidance and intentions, leading to the outcome of behaviour change.

RATIONALE

CED consumption has become increasingly prevalent among young people, and many adverse health effects and risky behaviours have been associated with CED use. While it is possible that the product itself may be causing these negative consequences, the greater risks may be due to the type of user and the context in which CEDs are consumed, including during periods of physical activity, during alcohol use, as well as by younger consumers. There are many regulations surrounding CEDs in Canada, including those surrounding advertising and marketing claims. Health Canada does not recommend the consumption of CEDs by children, as well as during sports and with alcohol.¹ Despite these recommendations, CED use has been shown to be popular within these contexts, and pose elevated risks apart from regular consumption.

Along with the rise in CED consumption prevalence, the marketing of products has also risen. To date, there has been very little research on CED marketing and the extent to which these products are promoting use by young people, during sports, and with alcohol. While a few previous studies have found evidence of industry practices and exposure to CED marketing, little research has been conducted on ad perceptions other than two previous studies. Both of these studies showed that real energy drinks ads were perceived as targeting young people.^{104,107} In addition, this research showed that associations were made between CED ads and both sports and alcohol.^{104,107}

There are several evidence gaps related to CED marketing. First, very little research has been conducted on ad perceptions, especially in the context of promoting use by young people, during sports, and with alcohol. In addition, no research to date has been conducted on exposure to educational messages that warn about the potential health risks of CEDs, which is extremely important given the potentially serious adverse health effects associated with CED consumption. In fact, many have called for an increase in attention to CEDs, including increasing education of the health risks associated with consuming CEDs, restricting the sales of CEDs to children and adolescents, as well as enforcing responsible marketing of CEDs.^{35,114–117}

RESEARCH QUESTIONS

The primary objective of the current study is to examine exposure and perceptions of caffeinated energy drink marketing among youth and young adults aged 12-24 in Canada. The study will address the following research questions:

Study 1:

1. What is the prevalence of exposure to marketing of CEDs and which variables are associated with exposure?
2. What is the prevalence of exposure to educational messages that warn about the potential health risks of CEDs and which variables are associated with exposure?

Study 2:

1. What is the perceived target age group of energy drink ads?
2. To what extent, if at all, are ads perceived as promoting use of CEDs during sports, and are there any differences in perceptions by sex, age group, ever-use of CEDs, and exposure to energy drink marketing channels?
3. To what extent, if at all, are ads perceived as promoting use of CEDs with alcohol, and are there any differences by sex, age group, ever-use of CEDs, and exposure to energy drink marketing channels?

METHODS

STUDY PROTOCOL

The current study was part of a larger national study whose primary objective was to evaluate the impact of Canada's caffeinated energy drink policy among youth and young adults aged 12-24. Data from the current study was collected in 2015: Online surveys (~20 minutes) were conducted between November 6, 2015 and December 22, 2015. The study was reviewed by the Office of Research Ethics at the University of Waterloo and received ethics clearance (ORE #19401).

PARTICIPANTS

Inclusion criteria for participation in the study included being between the ages of 12-24 and residing in Canada. There was a target sample of 2000 youth and young adults aged 12-24 (1000 youth aged 12-17, and 1000 young adults aged 18-24) across Canada.

Respondents were recruited via email through the Legerweb consumer panel, which has over 400,000 active members, half of them sampled using probability-based methods.¹¹⁸ Invitations to participate in the study were staggered over all seven days of the week. Reminders to participate in the study, if members had not already done so, were sent every two to three days. Invitations to participate in the study were sent in respondents' preferred language as recorded by Léger, either French or English, and surveys were also completed in the preferred language.

After members clicked the invitation link, they were screened for their age. Adults (aged 18-24) were taken to the survey introduction, while youth (aged 12-17) were asked for their parents to refer to the survey. After parents of children aged 12-17 provided consent, they were asked to refer their child to the survey. Those younger than 12 years were ineligible, and those aged 25 and older were screened for the presence of children aged 12-17 who would be eligible to participate. After screening, but before the start of the survey, participants were given information about the study and were asked to give consent to take part in the study.

A total of 37,152 were sent an invitation email, of which 8.4% (3,108) accessed the link. Of those who accessed the link, a total of 2,181 completed the survey. Due to missing data on variables used for weighting [sex(n=6), ID(n=1), or province(n=15)], 22 were deleted. One record was completed after the survey was closed and was also deleted. A further 103 records were deleted due to data quality concerns. Therefore, a total of 2,055 were retained for analysis (1,022 youth age 12-17 and 1,033 young adults age 18-24). The participation rate was 5.5% (2055 complete/37,152 invitations) based on AAPOR (2015) standard definitions (number of people who have provided a usable response divided by the total number of initial personal invitations requesting participation).¹¹⁹ Sample weights were constructed based on population estimates from the 2011 National Household Survey.¹²⁰ Sample probabilities were created for 40 demographic groups (age group by sex by region) based on weighted NHS proportions, and applied to the data set. All respondents received remuneration from Léger, including a monetary reward that could be redeemed as cash or donated, as well as monthly chances to win monetary and other prizes. The study protocol and participants mentioned in this section apply to both Study 1 and Study 2, outlined below.

STUDY 1

The aim of Study 1 was to evaluate exposure to energy drink marketing and educational messages that warn about the potential health risks of energy drinks.

Measures

Exposure to energy drink marketing

Participants were asked 'Have you ever seen the following types of ads or marketing for energy drinks?' and could select all that apply from the following response options: *Ads on TV; As a part of social media sites, like Facebook or Twitter; Ads online/on the internet; Ads in magazines or newspapers; Posters or signs in a convenience or grocery store; Promotion or sponsorship, such as logos or links with events, sports teams or athletes; Free samples of energy drinks or shots; Giveaways of branded merchandise (i.e., energy drink swag); Cars/vehicles with energy*

drink branding; Other → please specify [open-ended]; None of the above; Don't know; Refuse to answer. 2. A *Marketing Exposure Index*, ranging from 0-10, was created by summing the number of channels respondents reported they had seen CED marketing (refusals not included; "don't know" responses treated as "no"). For each channel selected, respondents were also asked about the last time they saw that type of marketing, with the following response options: *In the last 24 hours; In the last 7 days; In the last 30 days; In the last 6 months; In the last 12 months; More than 12 months ago; Don't know; Refuse to answer.*

Exposure to educational messages

Participants were asked 'Have you seen or heard any educational messages that warn about the potential health risks of energy drinks? For example, in print, at school, on TV or radio, or other places.' and could select one of the following response options: *Yes; No; Don't know; Refuse to answer.* If participants responded with 'Yes' they were asked 'Where have you seen educational messages that warn about the potential health risks of energy drinks? and could select all that applied from the following list: *Newspaper or magazine; Poster or billboard; At school; On TV; On the radio; Online/Internet; In a store; Somewhere else → please specify [open ended]; Don't know; Refuse to answer.* An *Educational Message Exposure Index*, ranging from 0-8, was created by summing the number of channels respondents reported they had seen an educational message (refusals not included; "don't know" responses treated as "no"). Respondents were also asked 'When was the last time you saw an educational message that warned about the potential health risks of energy drinks?' and could select one of the following response options: *In the last 24 hours; In the last 7 days; In the last 30 days; In the last 6 months; In the last 12 months; More than 12 months ago; Don't know; Refuse to answer.*

Covariates

Age. During participant screening, respondents were asked 'Before we begin, how old are you?' and could enter an age or refuse to answer.

Sex. During participant screening, respondents were asked ‘Are you male or female?’ and could select one of the following response options: *Male; Female; Refuse to answer.*

Language. Respondents completed the survey in their preferred language, either in English or French, as recorded by Léger.

Race/Ethnicity. Respondents were asked ‘People living in Canada come from many different cultural and racial backgrounds. Are you...’ and could select all that apply from the following response options: *White; Chinese; South Asian (e.g., East Indian, Pakistani, Sri Lankan); Black; Filipino; Latin American; Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese); Arab; West Asian (e.g. Afghan, Iranian); Japanese; Korean; Other; Don’t know; Refuse to answer.* Respondents were also asked ‘Are you an Aboriginal person, that is First Nations (North American Indian), Metis, or Inuk (Inuit)?’ and could select one of the following response options: *Yes; No; Don’t know; Refuse to answer.* Response options were re-coded into 3 categories: *White (only), Mixed/Other/Don’t know/Refused, and Aboriginal (any).*

Region. Respondents were asked ‘What province do you live in?’ and could select one of the following response options: *Alberta; British Columbia; Manitoba; New Brunswick; Newfoundland and Labrador; Nova Scotia; Ontario; Prince Edward Island; Quebec; Don’t know; Refuse to answer.* Response options were re-coded into 5 categories: *British Columbia, Prairies (AB, SK, MB), Ontario, Quebec, and Atlantic (NB, NL, NS, PEI).*

Education of mother. Respondents were told: ‘The next two questions are about your parents. By parents (“mother”, or “father”), we mean whoever you consider your parents/guardians to be. They could be your birth parents, adoptive parents, stepparents, foster parents, or legal guardians’. Respondents were asked ‘What is the highest level of education your mother completed?’ and could select one of the following response options: *Did not attend school; Attended high school; Graduated high school; Attended college; Graduated college; Attended university; Graduated university; Don’t know; Refuse to answer.*

School grades. Respondents were asked ‘On average, what marks [do/did] you usually get [when you were] in school?’ and could select one of the following response options: *Below 50% (Mostly Fs); 50-59% (Mostly Ds); 60-69% (Mostly Cs); 70-79% (Mostly Bs); 80-89% (Mostly As or A+s); 90-100% (Mostly A+); Don’t know.*

Ever-use of energy drinks. Respondents were asked ‘Have you ever tried an energy drink, even a few sips? Include energy drinks mixed with other drinks’ and could select one of the following response options: *Yes; No; Don’t know; Refuse to answer.*

Extreme sports viewer. Respondents were asked ‘Do you watch or follow any extreme sports?’ and could select one of the following response options: *Yes; No; Don’t know; Refuse to answer.*

Awareness of AmEDs. Respondents were asked ‘Have you ever heard of mixing alcohol with energy drinks?’ and could select one of the following response options: *Yes; No; Don’t know; Refuse to answer.*

Analysis

Descriptive statistics were used to determine prevalence of exposure to marketing and educational messages that warn about the potential health risks of CEDs, overall, as well as by age group and sex. A negative binomial regression model was fitted to determine sociodemographic correlates of exposure to energy drink marketing channels using the *Marketing Exposure Index*. Due to overdispersion, a negative binomial regression model was used, rather than a Poisson regression model. Using a count model is beneficial with count data because this type of model accounts for the use of non-negative integer values. A logistic regression model was fitted to determine sociodemographic correlates of exposure to educational messages. Sex, age group, language, race/ethnicity, and region were included in each model. Additional covariates (maternal education, school grades, ever-use of energy drinks, extreme sport viewership, and awareness of alcohol mixed with energy drinks) were

screened for inclusion in the models by testing bivariate correlations with the outcomes; those with an association at the $p < 0.2$ level were included in the model. The negative binomial regression model included all covariates: sex, age group, language, race/ethnicity, region, maternal education, school grades, ever-use of CEDs, extreme sport viewership, and awareness of alcohol mixed with energy drinks. The logistic regression model included all covariates except school grades and CED ever-use. Reported estimates are weighted, unless otherwise specified. Analyses were conducted using IBM SPSS version 24 and SAS version 9.4.

STUDY 2

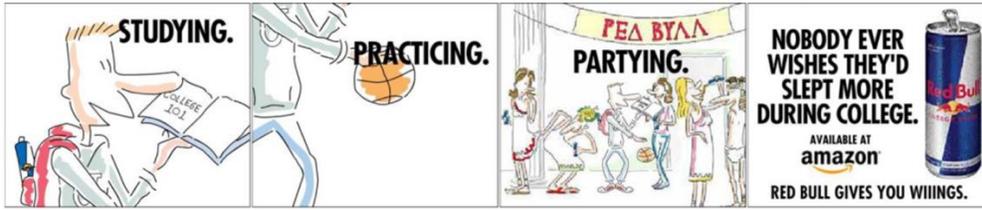
After responding to questions about exposure to CED marketing and educational messages, respondents completed three experiments in which they were randomized to view different CED advertisements. The aim of Study 2 was to examine perceptions of CED ads in association with sports and alcohol use, as well as target age groups. All ads shown in the experiments were 'real' ads that were identified through an online search. The first experiment included two sports/party themed ads as well as a control ad featuring 'product information' only (see Table 1), while the second experiment included a sports-themed only ad and a control ad (see Table 2), and the third experiment included a party-themed only ad and a control ad (see Table 3). This set of experiments helped to examine sensitivity of consumer perceptions to specific ad content, to address any concerns related to demand effects or social desirability bias on response patterns.

Table 1. Ads shown in experiment 1

Control condition



Sports/party-themed condition A



Sports/party-themed condition B



Table 2. Ads shown in experiment 2

Control condition



Sports-themed condition

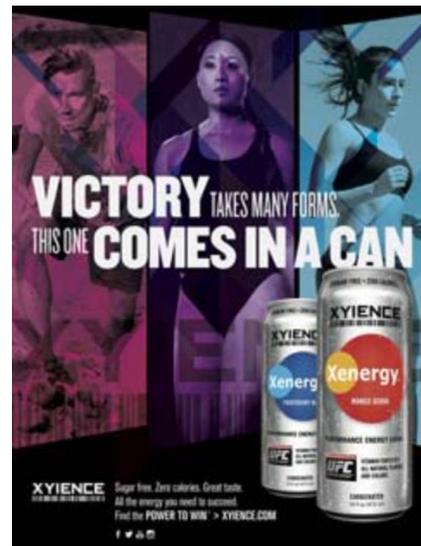


Table 3. Ads shown in experiment 3

Control condition	Party-themed condition
	

Measures

In each experiment, respondents were asked three questions with the randomized ad on screen. Respondents were asked ‘What age group does this ad target?’ and could select all that apply from the following response options: *People younger than me; People my age; People older than me; Don’t know; Refused to answer*. Respondents were also asked ‘Does this ad promote using these energy drinks during sports?’ and could select one of the following response options: *Yes; No; Don’t know; Refuse to answer*. Respondents were also asked ‘Does this ad promote using these energy drinks with alcohol?’ and could select one of the following response options: *Yes; No; Don’t know; Refuse to answer*.

Covariates

The following covariates outlined in Study 1 were also used in Study 2: age, sex, and ever-use of CEDs. Exposure to energy drink marketing channels, as determined by the *Marketing Exposure Index* from Study 1, was also used.

Analysis

Descriptive statistics were used to determine response prevalence for each outcome, by condition. To examine whether randomization was effective in balancing experimental conditions, chi-square tests were conducted to test differences in sociodemographic characteristics (sex, age group, ever-use of CEDs, and exposure to energy drink marketing channels as determined by the *Marketing Exposure Index*) between conditions. The tests revealed differences in CED ever-use for experiments 2 ($X^2=4.89$; $p=0.03$) and 3 ($X^2=15.8$; $p<0.001$), and age group for experiment 3 ($X^2=8.40$; $p=0.04$); therefore, all models adjusted for sex, age group, ever-use of CEDs, and exposure to CED marketing channels.

Outcomes for each of the experiments were re-coded into binary variables. The target age outcome variable was recoded from *People younger than me*; *People my age*; *People older than me*; *Don't know*; *Refuse to answer* into *People younger than me*; *People my age/people older than me*. The sports and alcohol outcome variables were both recoded from *Yes*; *No*; *Don't know*; *Refuse to answer* into *Yes*; *No*.

For each of the three experiments, separate logistic regression models were fitted to examine the effect of condition (i.e., ad) on each of the following three outcomes: 1) perceiving the ad targets 'people younger than me'; 2) perceiving the ad promotes using CEDs during sports; and, 3) perceiving the ad promotes using CEDs with alcohol. Two-way interactions between the experimental condition and the other covariates were also tested. For each experiment, any significant ($p<0.05$) 2-way interactions were fitted in a final model.

RESULTS

MANUSCRIPT 1

Exposure to caffeinated energy drink marketing and educational messages among youth and young adults in Canada

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Conflicts of interest: None to declare.

OBJECTIVE: To evaluate young Canadians' exposure to energy drink marketing and educational messages that warn about the potential health risks of energy drinks.

METHODS: An online survey was conducted in 2015 with youth and young adults aged 12-24 years recruited from a national online panel (n=2,023). Respondents were asked about their exposure to energy drink marketing via ten channels, and to educational messages that warn about the potential health risks of energy drinks. Regression models examined correlates of exposure to marketing and to educational messages.

RESULTS: Over 80% of respondents reported ever seeing energy drink marketing through at least one channel, most commonly television (58.8%), posters or signs in a convenience or grocery store (48.5%), and online ads (45.7%). Respondents reported a mean of 3.4 marketing channels (SD=2.9) out of ten. Respondents aged 18-19 (vs. 12-14 and 15-17) and 20-24 (vs. 12-14 and 15-17) reported significantly more channels of exposure to marketing. Overall, 32% of respondents reporting ever seeing an educational message about energy drinks. The most frequently reported sources of exposure were at school (16.2%), online (15.0%), and on television (12.6%). Respondents aged 18-19 (vs. 12-14, 15-17 and 20-24) and 20-24 (vs. 15-17) were significantly more likely to report having seen an educational message.

CONCLUSIONS: Exposure to energy drink marketing was common among youth and young adults and was significantly more prevalent than exposure to educational messages that warn about the potential health risks of energy drinks.

INTRODUCTION

Marketing of caffeinated energy drinks (CEDs) has risen dramatically in recent years. In the US, advertising expenditures for energy drinks increased 250% between the years 2008 to 2012.¹ In 2013, beverage companies spent \$175 million on advertising energy drinks in the US, comprising over 20% of the advertising expenditure for sugary drink and energy drink categories.²

CED manufacturers typically target young people and males, reaching their target audience through a wide variety of marketing channels.²⁻⁴ In Canada, previous related research on youth and young adults aged 12-24 found that over 80% of respondents reported ever seeing a CED advertisement, with TV being the most common source of exposure, followed by posters or signs in a convenience or grocery store, and ads on the internet.⁵ Recent Canadian research showed that Red Bull Energy Drink is one of the top five most frequently advertised food and beverage products on children's and teens' favourite websites.⁶ Further, qualitative research in the UK found that respondents aged 10-14 identified a wide variety of media through which they were targeted with CED promotional messages, including the internet, TV, computer games, bus stop advertisements, supermarket promotions, and sponsorship of sports or other events.⁷ For example, Red Bull has a significant involvement with eSports, hosting events and sponsoring players, which has essentially allowed the brand to become part of the eSports market. There is evidence that CED marketing is effective: one study found that exposure to digital marketing for the websites and social media sites of two popular brands of CEDs improved young adult participants' attitudes, as well as purchase and consumption intention of energy drinks.⁸

With the increase in CED marketing, there has also been an increase in consumption, which is concerning given the association of CED consumption with adverse health effects and other risky behaviours. For example, previous related research showed that over half of youth and young adults in Canada who had ever used CEDs had experienced an adverse event from consumption, including fast heartbeat, difficulty sleeping, headaches,

nausea/vomiting/diarrhea, chest pain, and seizures.⁹ Consumption of CEDs is also associated with other risky behaviours including alcohol use, smoking, and other substance use.¹⁰ While caffeine is generally safe in quantities outlined by Health Canada, there appears to be greater risks from consuming CEDs in comparison to other sources of caffeine like coffee.⁹ Given the potential adverse health effects and risks, Health Canada does not recommend the consumption of CEDs by certain sub-populations, including children 12 years of age and younger. For this reason, CEDs are prohibited from being marketed to children.¹¹ In addition, the Canadian Beverage Association has voluntary marketing codes restricting the advertisement of CEDs in programming (TV, radio, print or digital) where 35% or more of the audience is under 12 years of age.^{12,13} In addition to advertising to children, CEDs are also prohibited from being promoted for use during sports or with alcohol.¹¹ These marketing restrictions, along with other regulations such as cautionary ‘warning’ statements on the product label, were implemented by Health Canada in 2012, and are part of the Temporary Marketing Authorization granted to CEDs.¹¹

Despite these regulations, CEDs are still commonly marketed to and consumed by young people and used within contexts that are advised against. Consequently, the number of emergency visits related to CEDs has increased heavily, with evidence from the US that CED-related emergency department visits doubled between 2007 and 2011.¹⁴ Many have called for increased public health measures surrounding CEDs, including increasing education regarding the health risks associated with consuming CEDs, restricting the sales of CEDs to children and adolescents, as well as enforcing responsible marketing of CEDs.^{3,15-18} While no previous studies have examined exposure or effectiveness of educational messages within the context of CEDs, the evidence on the effectiveness of educational messages for other products is limited and variable. For example, while an educational poster aimed at reducing sugar sweetened beverage consumption reduced choice of sugar sweetened beverages, greater effects were seen when an educational poster was combined with price increases.²⁰ While educational messages have been shown to be very important in some domains, including reducing smoking prevalence,²¹⁻²³ generally, successful behaviour change efforts involve multiple strategies.²⁴

To date, little research has assessed exposure to CED marketing among youth and young adults in Canada. Further, no research has been conducted on exposure to educational messages that warn about the potential health risks of consuming CEDs. The current study sought to determine a) the prevalence of exposure to marketing of CEDs, and b) the prevalence of exposure to educational messages that warn about the potential health risks of CEDs. Sociodemographic characteristics associated with exposures were also examined.

METHODS

Data were collected via self-completed online surveys, between November 6, 2015 and December 22, 2015.

Sample & Recruitment

Respondents were recruited via email through the Legerweb consumer panel, which has over 400,000 active members, half of them sampled using probability-based methods.²⁵

Respondents aged 18-24 were recruited directly. Respondents aged 12-17 were recruited through their parents and parental consent was obtained prior to youth accessing the survey. All respondents were provided with information about the study and asked to give consent before participating. The survey was available in English or French and took approximately 20 minutes to complete. Respondents received remuneration from Léger in accordance with their usual incentive structure, which allows respondents to earn points or monetary rewards (redeemed as cash or donated), as well as chances to win monthly prizes.

A total of 2,181 respondents completed the survey. Records were deleted due to missing data on variables used for weighting (n=22) and other variables of primary interest (n=32), completion outside of the study timeframe (n=1) or failing a data quality check question that asked for the current month (n=103). Thus, a total of 2,023 were retained for analysis. Sample weights were constructed based on population estimates from the 2011 National Household Survey (NHS).²⁶ Sample probabilities were created for 40 demographic groups (age group by sex

by region) based on weighted NHS proportions, and applied to the data set. The study was reviewed by and received ethics clearance from the Office of Research Ethics at the University of Waterloo. No personal identifiers were collected as part of the study.

Measures

Sample characteristics

Respondents were asked about the following sociodemographic characteristics: sex, age (categorized as 12-14, 15-17, 18-19, or 20-24), race/ethnicity [12 categories; re-coded as white (only), mixed/other/don't know/refused, or Aboriginal (any)], province of residence (recoded into region: British Columbia, Prairies, Ontario, Quebec, or Atlantic), mother's education level [recoded as less than high school, high school graduate, college (some/completed), university (some/completed), or don't know/refused to answer], and usual grades in school. They were also asked if they had ever consumed energy drinks, if they watch or follow extreme sports, and if they had ever heard of mixing alcohol with energy drinks (see Table 1).

Exposure to energy drink marketing

Respondents were asked, 'Have you ever seen the following types of ads or marketing for energy drinks?' and could select all that applied from the list of 10 channels shown in Table 2. A *Marketing Exposure Index*, ranging from 0-10, was created by summing the number of channels through which respondents reported they had seen CED marketing (refusals excluded; "don't know" recoded as "no"). For each channel selected, respondents were also asked about the last time they saw that type of marketing, with the following response options: *In the last 24 hours; In the last 7 days; In the last 30 days; In the last 6 months; In the last 12 months; More than 12 months ago; Don't know; Refuse to answer.*

Exposure to educational messages

Respondents were asked, 'Have you seen or heard any educational messages that warn about the potential health risks of energy drinks? For example, in print, at school, on TV or radio, or other places.' and could select *Yes; No; Don't know; Refuse to answer.* If respondents selected

'Yes' they were asked, 'Where have you seen educational messages that warn about the potential health risks of energy drinks?' and could select all that applied from the list of eight channels shown in Table 2. An *Educational Message Exposure Index*, ranging from 0-8, was created by summing the number of channels through which respondents reported they had seen an educational message (refusals excluded; "don't know" recoded as "no"). Respondents were also asked, 'When was the last time you saw an educational message that warned about the potential health risks of energy drinks?' and could select one of the following response options: *In the last 24 hours; In the last 7 days; In the last 30 days; In the last 6 months; In the last 12 months; More than 12 months ago; Don't know; Refuse to answer.*

Analysis

Descriptive statistics were used to estimate prevalence of exposure to marketing and to educational messages that warn about the potential health risks of CEDs, overall, as well as by age group and sex. A negative binomial regression model was fitted to determine sociodemographic correlates of number of channels of exposure to energy drink marketing using the *Marketing Exposure Index*. Due to overdispersion, a negative binomial regression model was used, rather than a Poisson regression model. Using a count model is beneficial with count data because this type of model accounts for the use of non-negative integer values. A logistic regression model was fitted to determine sociodemographic correlates of any exposure to educational messages. Sex, age group, language, race/ethnicity, and region were included in each model. Additional covariates (maternal education, school grades, ever-use of energy drinks, extreme sport viewership, and awareness of alcohol mixed with energy drinks) were screened for inclusion in the models by testing bivariate correlations with the outcomes; those with an association at the $p < 0.2$ level were included in the model. The negative binomial regression model included all covariates: sex, age group, language, race/ethnicity, region, maternal education, school grades, ever-use of energy drinks, extreme sport viewership, and awareness of alcohol mixed with energy drinks. The logistic regression model included all covariates except school grades and ever-use of energy drinks. Reported estimates are

weighted, unless otherwise specified. Analyses were conducted using IBM SPSS version 24 and SAS version 9.4.

RESULTS

Sample characteristics

Table 1 presents characteristics of the respondents in the analytic sample.

Exposure to energy drink marketing

Table 2 presents places where respondents reported seeing energy drink marketing, overall, as well as by age group and sex. The majority of respondents (81.8%) reported ever seeing marketing through at least one channel. Overall, respondents selected a mean of 3.4 channels (SD=2.9) out of the 10 listed. The most common sources of marketing exposure were ads on TV, posters or signs in a convenience or grocery store, and ads online/on the internet. The majority of respondents who reported seeing marketing had seen it within the last month. Among respondents who had seen ads on TV, 51.3% reported seeing one in the last 30 days, including 30.4% who reported seeing one in the last week. Among those who had seen posters or signs for CEDs in a convenience or grocery store, 76.3% reported seeing one in the last 30 days, including 40.5% seeing one in the last week. For those who had seen CED ads online/on the internet, 68.3% reported seeing one in the last 30 days, including 46.1% seeing one in the last week.

In a negative binomial regression model, the number of channels of exposure to CED marketing was significantly associated with age group, race/ethnicity, geographic region, ever-use of energy drinks, extreme sports viewership, and awareness of alcohol mixed with energy drinks (see Table 3). Older respondents, particularly those aged 18-19 (vs. 12-14 and 15-17) and 20-24 (vs. 12-14 and 15-17) reported a significantly greater number of channels of exposure to marketing. The difference between respondents aged 18-19 and 20-24 was of borderline significance, with those aged 18-19 reporting a greater number of channels. Respondents who were white (vs. mixed/other/not stated) reported a significantly greater number of channels of

exposure to marketing. Although respondents who identified as Aboriginal reported the greatest number of channels of exposure, the difference was not significant compared to 'white' respondents and was of borderline significance when compared to those who identified as mixed/other/not stated. This finding may be due to the smaller Aboriginal sample size. Respondents who resided in the Prairies reported a significantly greater number of channels of exposure to marketing, compared to British Columbia and Ontario. Those who reported they had ever consumed CEDs, watched extreme sports, or had an awareness of mixing alcohol with energy drinks reported a significantly greater number of channels of exposure to marketing. No differences were observed for sex, language of survey, maternal education, or school grades.

Exposure to educational messages

In total, 32% (n=647) reported they had seen an educational message. Table 2 presents places where educational messages were seen, overall, as well as by age group and sex. Overall, respondents reported a mean of 0.63 channels (SD=2.9) out of 8. The most common sources of educational message exposure included at school, online/internet, and on TV. While most respondents (68%) had never seen an educational message, 1.1% saw an ad in the last 24 hours, 2.3% saw one in the last 7 days, 4.8% saw one in the last 30 days, 6.9% saw one in the last 6 months, 6.0% saw one in the last 12 months, 6.2% saw one more than 12 months ago, and 4.6% reported that they did not know the last time they saw one.

In a logistic regression model, reporting any exposure to educational messages was significantly associated with age group, language of survey, geographic region, maternal education, extreme sports viewership, and awareness of alcohol mixed with energy drinks (see Table 4).

Respondents aged 18-19 (vs. 12-14, 15-17 and 20-24) and 20-24 (vs. 15-17) were significantly more likely to report having seen an educational message. Those who completed the survey in French were significantly more likely to report having seen an educational message than those who completed the survey in English. Residents of Quebec were significantly more likely to report having seen an educational message than residents of British Columbia and Ontario. Respondents whose mother completed high school were significantly more likely to report

having seen an educational message than those who reported Don't know/not stated, and borderline more likely than respondents whose mothers had less than a high school education. Those who were extreme sports viewers or had an awareness of mixing alcohol with energy drinks were also significantly more likely to report having seen an educational message. No differences were observed for sex or race/ethnicity.

DISCUSSION

The current study suggests that over 80% youth and young adults in Canada have seen marketing for energy drinks, many through multiple channels (an average of 4). The most common sources of exposure were ads on TV, posters or signs in a convenience or grocery store, and ads online/on the internet, which is consistent with previous related research.⁵ In addition, prevalence of exposure was high for many of the channels, consistent with previous findings indicating that young people are exposed to CED marketing through a wide variety of marketing channels.^{5,7}

Respondents who were older, had ever consumed energy drinks, were extreme sports viewers, or who were aware of mixing alcohol with energy drinks were more likely to report a greater number of channels of exposure to CED marketing. These findings make sense given that those who are older most likely have had higher exposure to ads in general. In addition, those who have had experience and awareness of CEDs and CED-related attributes such as extreme sports and mixing alcohol with energy drinks would also be expected to have a greater exposure to CED marketing channels, given that marketing of CEDs is often featured alongside these attributes^{2,27} and through multiple consumer targeted mediums. Marketing impacts choices and behaviours^{28,29} and so exposure to CED marketing would be expected to result in a greater likelihood of having consumed the product. Sex, language, maternal education, and school grades were not significantly associated with exposure to CED marketing channels. As CED marketing typically features content that is appealing to males^{2,4}, we expected males to have a greater exposure to CED marketing channels; however the current findings suggest that CED marketing is reaching both males and females through a similar number of channels. This

finding may be due to the broad range of marketing channels that are being used to reach consumers, some of which may have similar reach among both males and females.

To our knowledge, the current study is the first to examine exposure to educational messages that warn about the potential health risks of energy drinks. The results indicate that exposure to educational messages was relatively low, reported by only about one-third of respondents. Out of eight possible channels of educational message exposure, respondents reported an average exposure to less than one channel. The findings are not surprising given that we are unaware of any comprehensive campaigns to educate consumers of the health risks associated with consuming CEDs. In contrast to marketing, if there are public health education campaigns, they are less prominent or visible. To illustrate, in a qualitative study conducted with young people aged 12-25 in Australia, many respondents were oblivious to even the cautionary statements provided on energy drink cans, suggesting that visibility of such messages needs to be increased.¹⁹ The respondents also suggested educational intervention strategies, among many other strategies, to reduce energy drink consumption, including implementing school visits and interactive educational sessions, having health messages show on news stories or television ads, educating parents, and developing practitioner-based strategies.¹⁹

Given that educational message interventions generally produce the most effective behaviour change outcomes when combined with other strategies,^{20,24} other components such as increasing price, restricting sales to minors, changing product packaging, enforcing responsible marketing, and reducing visibility in retail outlets may also be warranted.¹⁹ Respondents who were older, completed the survey in French, resided in Quebec, were extreme sport viewers, and had an awareness of mixing alcohol with energy drinks were more likely to report having seen an educational message. These findings make sense given that those who are older have most likely had more opportunities for exposure to education surrounding CEDs, among other health behaviours. The association between speaking French and residing in Quebec and having a greater exposure to educational messages surrounding CEDs warrants further research, such as a survey of regional differences in the implementation of educational campaigns. No

consistent association was found for maternal education. Sex and ethnicity were not associated with having seen an educational message.

Limitations

The current study has limitations common to survey research. The sample was recruited through a web panel, and therefore was not probability-based, which may limit generalizability. Web panels pose issues such as self-selection bias, as members opt-in. Further, nonresponse, either in recruitment (non-contact, refusal, or unavailability) or through attrition, is usually prevalent with web panels. However, the sample included all provinces, and survey weights were applied to match national estimates for age, sex, and geographic region. Recall bias is also a possibility. For example, those who find certain ads relevant may be more likely to remember them, leading to selective recall. Though, the current findings are consistent with data showing that TV accounts for the majority of advertising expenditure for energy drinks,² as well as findings from previous related research.⁵

Conclusions

Findings from the current study indicate that exposure to CED marketing is prevalent among youth and young adults in Canada, significantly more so than exposure to educational messages that warn about the potential health risks of CEDs. Current regulations enacted by Health Canada, as well as the beverage industry's voluntary marketing codes, prohibit the marketing of CEDs to children; however, this study, along with other previous studies, provides evidence that current policies are ineffective in this regard, and CED marketing is reaching young people.^{1,2,5-7} Regulatory enforcement or amendments may help to address the ineffectiveness of current policies. In addition, while health professionals have called for an increase in education regarding the risks of energy drinks, the current study reiterates that exposure to educational messages is low. As educational messages are typically more effective when combined with other strategies, a comprehensive policy approach, as has been successful in reducing smoking prevalence, may be an effective approach in promoting lower-risk consumption of CEDs.

TABLES & FIGURES

Table 1. Sample characteristics of respondents in analytic sample, unweighted and weighted (n=2,023)

Characteristic	Unweighted % (n)	Weighted %
Sex		
Male	50.4% (1,004)	51.2%
Female	49.6% (1,019)	48.8%
Age group		
12-14	19.5% (395)	21.3%
15-17	30.3% (612)	23.5%
18-19	10.4% (210)	15.9%
20-24	39.8% (806)	39.3%
Language of survey		
English	60.3% (1,220)	78.0%
French	39.7% (803)	22.0%
Race/ethnicity		
White (only)	74.0% (1,498)	67.3%
Mixed/Other/Not stated	22.9% (463)	28.9%
Aboriginal (any)	3.1% (62)	3.8%
Region		
British Columbia	7.4% (150)	12.9%
Prairies (AB, SK, MB)	13.3% (269)	18.5%
Ontario	30.8% (623)	39.5%
Quebec	43.2% (874)	22.5%
Atlantic (NB, NL, NS, PEI)	5.3% (107)	6.5%
Maternal education level		
Less than high school	7.3% (147)	7.8%
High school graduate	18.9% (382)	18.3%
College (some/completed)	31.9% (645)	31.2%
University (some/completed)	39.7% (804)	40.2%
Don't know/Not stated	2.2% (45)	2.5%
School grades		
Below 50% (Mostly Fs)	0.3% (7)	0.3%
50-59% (Mostly Ds)	1.1% (23)	1.1%
60-69% (Mostly Cs)	9.9% (201)	10.0%
70-79% (Mostly Bs)	34.1% (690)	33.7%
80-89% (Mostly As or A+s)	41.3% (835)	41.6%
90-100% (Mostly A+)	11.5% (233)	11.3%
Don't know/Not stated	1.7% (34)	2.0%
Ever-use of energy drinks		
Yes	74.2% (1,501)	75.4%
No	25.8% (522)	24.6%
Extreme sports viewer		
Yes	15.8% (319)	15.3%
No	84.2% (1,704)	84.7%
Aware of alcohol mixed with energy drinks		
Yes	69.1% (1,397)	67.2%
No	30.9% (626)	32.8%

Table 2. Channels where energy drink marketing and educational messages were ever seen, overall, as well as by age group and sex (n=2,023)

	Overall	Age 12-14	Age 15-17	Age 18-19	Age 20-24	Male	Female
Places marketing seen							
Ads on TV	58.8% (1,189)	54.2% (234)	52.0% (248)	68.0% (218)	61.6% (490)	62.0% (642)	55.4% (547)
Posters or signs in a convenience or grocery store	48.5% (982)	44.7% (193)	46.4% (221)	53.3% (171)	50.0% (397)	48.5% (502)	48.6% (479)
Ads online/on the internet	45.7% (924)	40.2% (173)	40.8% (194)	53.9% (173)	48.3% (384)	49.0% (508)	42.2% (417)
As part of social media sites, like Facebook or Twitter	39.9% (807)	28.7% (124)	31.6% (151)	49.6% (159)	46.9% (374)	40.1% (415)	39.7% (392)
Promotion or sponsorship, such as logos or links with events, sports teams or athletes	37.8% (764)	26.7% (115)	32.0% (153)	50.1% (161)	42.2% (335)	39.4% (408)	36.1% (356)
Cars/vehicles with energy drink branding	34.1% (689)	26.8% (116)	22.3% (106)	43.9% (141)	41.1% (327)	36.4% (377)	31.6% (312)
Ads in magazines or newspapers	29.3% (592)	26.1% (112)	25.4% (121)	32.5% (104)	32.0% (255)	29.3% (304)	29.2% (288)
Free samples of energy drinks or shots	27.5% (557)	12.3% (53)	17.0% (81)	36.0% (115)	38.7% (308)	28.2% (293)	26.8% (264)
Giveaways of branded merchandise	20.9% (422)	13.1% (57)	10.4% (50)	29.5% (95)	27.8% (221)	22.2% (230)	19.5% (192)
Other	0.7% (15)	0.3% (1)	0.9% (4)	1.5% (5)	0.5% (4)	1.0% (10)	0.5% (4)
None of the above	13.1% (265)	16.3% (70)	15.9% (76)	7.3% (24)	12.0% (95)	12.5% (129)	13.7% (135)
Don't know	5.1% (103)	6.9% (30)	5.1% (25)	3.9% (13)	4.5% (36)	4.7% (48)	5.5% (54)
Marketing exposure index* (mean; SD)	3.4; 2.9	2.7; 2.6	2.8; 2.5	4.2; 3.0	3.9; 3.1	3.6; 3.0	3.3; 2.8
Places educational messages seen							
N/A - have not seen	68.0% (1,376)	73.3% (316)	74.3% (354)	56.1% (180)	66.2% (526)	67.4% (698)	68.6% (677)
At school	16.2% (328)	17.2% (74)	13.9% (66)	27.2% (87)	12.6% (101)	17.7% (183)	14.7% (145)
Online/internet	15.0% (304)	9.7% (42)	12.2% (58)	22.8% (73)	16.4% (131)	14.6% (152)	15.4% (152)
On TV	12.6% (255)	12.0% (52)	11.2% (53)	12.5% (40)	13.8% (110)	13.4% (139)	11.8% (116)
Newspaper or magazine	6.7% (136)	4.8% (21)	5.2% (25)	6.5% (21)	8.8% (70)	6.2% (64)	7.3% (72)
Poster or billboard	4.6% (93)	3.9% (17)	3.2% (15)	5.5% (18)	5.5% (44)	4.9% (51)	4.3% (42)
On the radio	4.0% (81)	2.7% (12)	2.9% (14)	6.0% (19)	4.6% (36)	4.3% (45)	3.7% (36)
In a store	3.0% (62)	3.2% (14)	1.8% (8)	3.6% (12)	3.5% (28)	3.5% (36)	2.6% (25)
Somewhere else	0.7% (14)	1.1% (5)	0.9% (4)	0.2% (1)	0.6% (5)	0.4% (4)	1.0% (10)
Don't know	1.8% (36)	1.2% (5)	0.5% (2)	3.1% (10)	2.4% (19)	1.4% (15)	2.2% (22)
Educational message exposure index* (mean; SD)	0.63; 2.9	0.55; 1.2	0.51; 1.1	0.84; 1.4	0.66; 1.2	0.65; 1.2	0.61; 1.2

NOTE: Percentages do not sum to 100, as respondents could select multiple response options.

*Marketing exposure index is the sum of the number of places where marketing was seen (range 0-10)

**Educational message exposure index is the sum of the number of places where educational messages were seen (range 0-8)

Table 3. Results from a negative binomial regression model, showing correlates of reporting a greater number of marketing channels, as defined by the *Marketing exposure index* (0-10) (n=2,023)

Characteristic (mean; SD)	X ² , p-value	IRR (95% CI)	p-value
Sex	1.33, p=0.25		
Age group	43.5, p<0.001		
18-19 (4.2; 3.0) vs. 12-14 (2.7; 2.6)		1.4 (1.2, 1.6)	<0.001
18-19 (4.2; 3.0) vs. 15-17 (2.8; 2.5)		1.4 (1.2, 1.6)	<0.001
18-19 (4.2; 3.0) vs. 20-24 (3.9; 3.1)		1.1 (1.0, 1.2)	0.05
20-24 (3.9; 3.1) vs. 12-14 (2.7; 2.6)		1.2 (1.1, 1.4)	<0.001
20-24 (3.9; 3.1) vs. 15-17 (2.8; 2.5)		1.3 (1.1, 1.4)	<0.001
15-17 (2.8; 2.5) vs. 12-14 (2.7; 2.6)		1.0 (0.9, 1.1)	0.66
Language of survey	1.13, p=0.29		
Race/ethnicity	7.93, p=0.02		
Aboriginal (4.2; 3.0) vs. mixed/other/not stated (3.0; 2.8)		1.2 (1.0, 1.5)	0.06
Aboriginal (4.2; 3.0) vs. White (3.6; 2.9)		1.1 (0.9, 1.3)	0.43
White (3.6; 2.9) vs. mixed/other/not stated (3.0; 2.8)		1.1 (1.0, 1.2)	0.01
Region	9.56, p=0.049		
Prairies (3.8; 2.9) vs. British Columbia (3.0; 2.9)		1.2 (1.0, 1.4)	0.02
Prairies (3.8; 2.9) vs. Ontario (3.3; 2.9)		1.1 (1.0, 1.3)	0.02
Prairies (3.8; 2.9) vs. Quebec (3.5; 2.8)		1.0 (0.9, 1.2)	0.65
Prairies (3.8; 2.9) vs. Atlantic (3.6; 2.7)		1.0 (0.8, 1.2)	0.75
Maternal education level	7.26, p=0.12		
School grades	8.82, p=0.18		
Ever-use of energy drinks	3.91, p=0.048		
Yes (3.7; 2.9) vs. No (2.7; 2.7)		1.1 (1.0, 1.2)	0.048
Extreme sports viewer	21.94, p<0.001		
Yes (4.0; 3.1) vs. No (3.3; 2.9)		1.3 (1.2, 1.4)	<0.001
Aware of alcohol mixed with energy drinks	167.43, p<0.001		
Yes (4.1; 2.9) vs. No (2.1; 2.3)		1.8 (1.6, 1.9)	<0.001

Table 4. Results from a logistic regression model, showing correlates of having ever seen an educational message that warns about the potential health risks of energy drinks (n=2,023)

Characteristic (%)	X ² , p-value	AOR (95% CI)	p-value
Sex	0.01, p=0.93		
Age group	33.52, p<0.001		
18-19 (43.9%) vs. 12-14 (26.7%)		2.2 (1.6, 3.1)	<0.001
18-19 (43.9%) vs. 15-17 (25.7%)		2.4 (1.8, 3.3)	<0.001
18-19 (43.9%) vs. 20-24 (33.8%)		1.7 (1.3, 2.2)	<0.001
20-24 (33.8%) vs. 15-17 (25.7%)		1.4 (1.1, 1.9)	0.009
20-24 (33.8%) vs. 12-14 (26.7%)		1.3 (1.0, 1.7)	0.07
15-17 (25.7%) vs. 12-14 (26.7%)		0.9 (0.7, 1.2)	0.53
Language of survey	5.22, p=0.02		
French (49.4%) vs. English (27.1%)		1.7 (1.1, 2.8)	0.02
Race/ethnicity	4.29, p=0.12		
Region	20.40, p<0.001		
Quebec (48.7%) vs. British Columbia (21.1%)		2.1 (1.2, 3.6)	0.009
Quebec (48.7%) vs. Ontario (26.2%)		1.6 (1.1, 2.6)	0.047
Quebec (48.7%) vs. Prairies (28.1%)		1.6 (0.9, 2.6)	0.09
Quebec (48.7%) vs. Atlantic (42.8%)		0.8 (0.4, 1.4)	0.37
Maternal education level	13.15, p=0.01		
High school (37.8%) vs. Don't know/not stated (12.7%)		4.3 (1.8, 10.3)	0.001
High school (37.8%) vs. Less than high school (28.2%)		1.5 (1.0, 2.3)	0.05
High school (37.8%) vs. College (30.8%)		1.3 (0.9, 1.7)	0.11
High school (37.8%) vs. University (32.3%)		1.2 (0.9, 1.6)	0.24
Extreme sports viewer	15.83, p<0.001		
Yes (40.4%) vs. No (30.5%)		1.7 (1.3, 2.3)	<0.001
Aware of alcohol mixed with energy drinks	29.80, p<0.001		
Yes (37.3%) vs. No (21.1%)		1.9 (1.5, 2.4)	<0.001

MANUSCRIPT 2

An experimental study on perceptions of energy drink ads among youth and young adults in Canada

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OBJECTIVE: To examine young people's perceptions of caffeinated energy drink (CED) ads in association with sports and alcohol use, as well as target age groups.

METHODS: An online survey was conducted in 2015 with youth and young adults aged 12-24 years recruited from a national commercial panel (n=2,010). Participants completed three experiments in which they were randomized to view CED advertisements for leading brands: 1) sports/party-themed ads, 2) sports-themed ad, and 3) party-themed ad, vs. control 'product information' ads for the same brands. For each ad, participants were asked about the perceived target age group, and if the ad promoted use of CEDs during sports and with alcohol. Logistic regression models were fitted to test for differences in outcomes between experimental conditions.

RESULTS: The majority of respondents reported that the energy drink ads, across all themes, targeted people their age. In experiment 1, both sports/party-themed ads were more likely to be perceived as promoting use of CEDs during sports (AOR=13.32; 95% CI 9.90, 17.91, and AOR=9.73; 95% CI 7.38, 12.81, respectively), and with alcohol (AOR=8.55; 95% CI 6.37, 11.48, and AOR=2.81; 95% CI 2.08, 3.78), compared to the control ad. In experiment 2, the sports-themed ad was more likely to be perceived as promoting use of CEDs during sports (AOR=15.02; 95% CI 11.83, 19.08), but not with alcohol, compared to the control ad. In experiment 3, the party-themed ad was more likely to be perceived as promoting use of CEDs with alcohol (AOR=13.79; 95% CI 10.69, 17.78), but not during sports, compared to the control ad.

CONCLUSIONS: Ads from leading energy drink brands are perceived as targeting young people and encouraging energy drink use during sports and with alcohol, despite Canadian regulations prohibiting these marketing practices.

INTRODUCTION

Consumption of caffeinated energy drinks (CEDs) has increased dramatically over the past decade, particularly among young people.^{1,2} In Canada, almost three quarters of young people have tried CEDs at least once in their lifetime.³ Concerns have been raised about potential adverse health effects and risks associated with consuming CEDs, particularly among young people.⁴⁻⁸ While moderate consumption of caffeine alone is associated with minimal risks, previous related research has shown that CEDs appear to pose greater risks.⁹ For example, over half of youth and young adults in Canada who had ever used CEDs reported experiencing an adverse event from their consumption, including fast heartbeat, difficulty sleeping, headaches, nausea/vomiting/diarrhea, and seizures.⁹ American data indicate that the number of emergency room visits related to CEDs doubled from 2007 to 2011.¹⁰

The risks associated with CED consumption may be due to the context in which these products are commonly consumed, including during physical activity. CED consumption is more common among athletes, who often consume CEDs shortly before, during, or after sports or physical activity.¹¹⁻¹⁴ Consuming CEDs during physical activity is not recommended, especially by children and adolescents, as it can cause a variety of adverse health effects, including restlessness and irritability, an increase in blood pressure, a reduction in insulin sensitivity, and dehydration.¹⁵⁻¹⁹ In fact, case studies have associated excess CED consumption before physical activity with cardiac arrest and even death.^{20,21}

Alcohol consumption also increases the risks of CED consumption. Consuming alcohol mixed with energy drinks is a common practice among young people, especially students.^{14,22-27} Mixing alcohol and energy drinks can reduce feelings of impairment and mask drowsiness associated with alcohol intake, which may increase the risk of dehydration, overconsumption of alcohol, and alcohol-related injury.²⁸ In addition, the consumption of alcohol with energy drinks is associated with an increased likelihood of risky behaviours, including driving while intoxicated or with an intoxicated driver, as well as being hurt or injured.^{29,30} Following the recent death of a 14-year-old girl who had consumed an alcoholic beverage containing natural caffeine, Health

Canada issued a reminder about safe levels of alcohol consumption, as well as advice not to mix alcohol with energy drinks.³¹ While current regulations prohibit adding caffeine to alcoholic beverages, a 'loophole' exists in which flavouring agents, including natural sources of caffeine such as guarana or coffee, may be added to alcoholic beverages.³²

In 2012, Canada implemented a new regulatory framework for CEDs in Canada.¹⁵ As part of the Temporary Marketing Authorization granted to CEDs, Health Canada does not recommend using CEDs for sport performance or mixing CEDs with alcohol.¹⁵ Cautionary statements required on products include "Not recommended for children..." and "Do not mix with alcohol".¹⁵ Alongside cautionary statements, CEDs must also comply with regulations surrounding advertising and claims. Under the Food and Drugs Act, the term 'advertisement' includes product representation by any means whatsoever that promotes the sale of the product, directly or indirectly.¹⁵ Any information that is not allowed on labels is also not allowed in advertising. Therefore, as per the cautionary statement on the product, CEDs should not be promoted to children, and should not be promoted for use with alcohol. Although not included as a cautionary statement on the product, health claims (implicit or explicit) promoting use of CEDs for physical performance (including physical exertion, endurance, aerobic, anaerobic, power, strength, motor performance, recovery, or sports) are prohibited.¹⁵

CED manufacturers have stated that they do not market their products to children or associate their products with alcohol.³³ However, analyses of the content of CED ads suggest that CED marketing typically targets younger audiences and males, and marketing often features athletes, sports, and popular entertainment.^{2,34} Marketing impacts choices and behaviours, as shown in other domains, such as food marketing.³⁵⁻³⁷ Importantly, young people, particularly children, are vulnerable to marketing messages. While very young children do not understand the intent of ads, children around the age of 10-12 are typically able to recognize that the purpose of an ad is to sell a product, however, they are not always able to critically assess the ad.³⁷ Even teenagers are susceptible to marketing as they are likely to believe industry tactics such as misleading claims.³⁷ There is little evidence on how young people perceive the content

of CED ads, which represents the best indicator of the impact of advertising content on consumer perceptions. A qualitative study on perceptions and knowledge of CEDs among Canadian youth aged 12-18 found that respondents perceived CED marketing practices such as the sponsorship of extreme sports events, as targeting their age group.³⁸ Respondents also made associations with ads and mixing alcohol with energy drinks.³⁸ Other previous research has also shown that young people perceive CED ads as targeting a young demographic, as well as promoting the use of CEDs during sports.³⁹

To date, there is little evidence on consumer perceptions of CED ads, apart from the two related studies mentioned previously.^{38,39} Previous related research experimentally tested perceptions of CED ads, focusing on target audience age and promotion of CED use during sports.³⁹ The current study sought to replicate and extend these results, by experimentally testing if CED ads are perceived as promoting CEDs for use during sports and with alcohol, as well as target age groups.

METHODS

Data were collected via self-completed, online surveys, between November 6, 2015 and December 22, 2015.

Sample & Recruitment

Respondents were recruited via email through the Legerweb consumer panel, which has over 400,000 active members, half of them sampled using probability-based methods.⁴⁰

Respondents aged 18-24 were recruited directly. Respondents aged 12-17 were recruited through their parents and parental consent was obtained prior to youth accessing the survey. All respondents were provided with information about the study and asked to give consent before participating. The survey was available in English or French and took approximately 20 minutes to complete. Respondents received remuneration from Léger in accordance with their usual incentive structure, which allows respondents to earn points or monetary rewards (redeemed as cash or donated), as well as chances to win monthly prizes.

A total of 2,181 respondents completed the survey. Records were deleted due to missing data on variables used for weighting (n=22) and other variables of primary interest (n=45), completion outside of the study timeframe (n=1) or failing a data quality check question that asked for the current month (n=103). Thus, a total of 2,010 were retained for analysis. Sample weights were constructed based on population estimates from the 2011 National Household Survey (NHS).⁴¹ Sample probabilities were created for 40 demographic groups (age group by sex by region) based on weighted NHS proportions, and applied to the data set. The study was reviewed by and received ethics clearance from the Office of Research Ethics at the University of Waterloo. No personal identifiers were collected as part of the study.

Measures

Sample characteristics

Respondents were asked about the following: sex, age (re-coded as 12-14, 15-17, 18-19, or 20-24), race/ethnicity [12 categories; re-coded as white (only), mixed/other/don't know/refused), or Aboriginal (any)], and province of residence (recoded into region: British Columbia, Prairies, Ontario, Quebec, Atlantic). They were also asked if they had ever consumed energy drinks, and about their exposure to CED marketing channels (using a 'select all that apply' list of 10 sources of marketing exposure). A *Marketing Exposure Index* was created by summing the number of places each respondent reported seeing energy drink advertising was reported (range 0-10), including 1) ads on TV, 2) posters or signs in a convenience or grocery store, 3) ads online/on the internet, 4) as part of a social media site, like Facebook or Twitter, 5) promotion or sponsorship, such as logos or links with events, sports teams or athletes, 6) cars/vehicles with energy drink branding, 7) ads in magazines or newspapers, 8) free samples of energy drinks or shots, 9) giveaways of branded merchandise, and 10) other.

Experiments

Respondents completed three experiments in which they were randomized to view different CED advertisements. Randomization was independent for each experiment. All ads shown in

the experiments were real ads for energy drink brands, identified through an online search. The first experiment included two sports/party-themed ads as well as a control ad featuring product information, while the second experiment included a sports-themed ad and control ad, and the third experiment included a party-themed ad and control ad (see Table 1). This set of experiments helped to examine sensitivity of consumer perceptions to specific ad content to address any concerns related to potential study demand effects or social desirability bias on response patterns.

In each experiment, respondents were asked three questions while the ad was shown on screen: 1) 'What age group does this ad target?', with select all that apply response options of *People younger than me, People my age, People older than me*; 2) 'Does this ad promote using these energy drinks during sports?', *Yes or No*; and, 3) 'Does this ad promote using these energy drinks with alcohol?', *Yes or No*. Response options of *Don't know* and *Refuse to answer* were also provided for each question.

Analysis

Descriptive statistics were used to determine response prevalence for each outcome, by condition. To examine whether randomization was effective in balancing experimental conditions, chi-square tests were conducted to test differences in sociodemographic characteristics (sex, age group, ever-use of CEDs, and exposure to energy drink marketing channels as determined by the *Marketing Exposure Index*) between conditions. The tests revealed differences in ever-use of CEDs for experiments 2 ($X^2=4.89$; $p=0.03$) and 3 ($X^2=15.8$; $p<0.001$), and age group for experiment 3 ($X^2=8.40$; $p=0.04$); therefore, all models adjusted for sex, age group, ever-use of CEDs, and exposure to CED marketing channels.

For each of the three experiments, separate logistic regression models were fitted to examine the effect of condition (i.e., ad) on each of the following three outcomes: 1) perceiving the ad targets 'people younger than me'; 2) perceiving the ad promotes using CEDs during sports; and, 3) perceiving the ad promotes using CEDs with alcohol. Two-way interactions between the

experimental condition and the other covariates were also tested. Weighted estimates are reported, unless otherwise specified. Analyses were conducted using IBM SPSS version 24 and SAS version 9.4.

RESULTS

Sample characteristics

Table 2 presents characteristics of the respondents in the analytic sample.

Experiment 1

The results from experiment 1 are presented in Figure 1 and Supplementary Table 1. The majority of respondents perceived each of the three ads targeted people their own age. Among respondents aged 12-14 and 15-17, 29.3% and 59.1%, respectively, reported that sports/party-themed ad A targeted people their age or younger; 33.1% and 55.0%, respectively, reported that sports/party-themed ad B targeted people their age or younger. Overall, there were no significant differences across conditions in perceiving a younger target audience ($X^2=2.7$, $p=0.26$).

As shown in Figure 1A, there were significant differences across conditions in perceiving the ad as promoting use of CEDs during sports ($X^2=378.1$, $p<0.001$): respondents were more likely to perceive the ad as promoting use of CEDs during sports if they viewed sports/party-themed ad A (AOR=13.32; 95% CI 9.90, 17.91) or B (AOR=9.73; 95% CI=7.38, 12.81), compared with the control ad. There were also significant interactions between condition and sex ($X^2=7.9$, $p=0.02$), and condition and exposure to energy drink marketing channels ($X^2=124.3$, $p<0.001$). Females were more likely than males to perceive that sports/party-themed ad B ($B=0.80$, $p=0.005$) promoted use of CEDs during sports relative to the control condition. Respondents who reported a greater number of channels of exposure to CED marketing were more likely to perceive that sports/party-themed ads A ($B=0.21$, $p<0.001$) and B ($B=0.11$, $p=0.02$) promoted use of CEDs during sports, relative to the control ad.

As shown in Figure 1B, there were significant differences between conditions in perceiving the ad as promoting using CED with alcohol ($X^2=218.0$, $p<0.001$): respondents were more likely to perceive the ad as promoting using CEDs with alcohol if they viewed sports/party-themed ad A (AOR=8.55; 95% CI 6.37, 11.48) or B (AOR=2.81; 95% CI=2.08, 3.78), compared to the control ad. There were also significant interactions between condition and sex ($X^2=7.2$, $p=0.03$), and condition and age group ($X^2=20.2$, $p=0.003$). Females were more likely than males to perceive sports/party-themed ad A as promoting use of CEDs with alcohol ($B=0.67$, $p=0.007$), relative to sport/party-themed ad B. Respondents aged 12-14 and 15-17 were more likely to perceive that sports/party-themed ad A promoted use of CEDs with alcohol compared to respondents aged 18-19 ($B=1.26$, $p=0.002$ and $B=1.01$, $p=0.01$, respectively) and 20-24 ($B=1.05$, $p=0.002$ and $B=0.82$, $p=0.01$, respectively), relative to sports/party-themed ad B. Respondents aged 20-24 were more likely to perceive that sports/party-themed ad B promoted use of CEDs with alcohol compared to respondents aged 12-14 ($B=0.98$, $p=0.02$) and 15-17 ($B=1.13$, $p=0.01$), relative to the control ad; this contrast was also significant for respondents aged 18-19 compared to respondents aged 15-17 ($B=1.00$, $p=0.04$).

Experiment 2

The results from experiment 2 are presented in Figure 2 and Supplementary Table 2. The majority of respondents perceived each ad as targeting people their own age. Among respondents aged 12-14 and 15-17, 26.9% and 42.4%, respectively, reported that the sports-themed ad targeted people their age or younger. Overall, there was a significant difference ($X^2=9.9$, $p=0.002$) between conditions in perceiving a younger target audience: respondents were more likely to perceive the ad as targeting people younger than them if they viewed the control ad compared to the sports-themed ad (AOR=1.55, 95% CI 1.18, 2.03). There were no significant interactions between condition and the sociodemographic variables.

As shown in Figure 2A, there was a significant difference between conditions in perceiving the ad as promoting use of CEDs during sports ($X^2=493.4$, $p<0.001$): respondents were more likely to perceive the ad as promoting use of CEDs during sports if they viewed the sports-themed ad

(AOR=15.02; 95% CI 11.83, 19.08) compared to the control ad. There were also significant interactions between condition and sex ($X^2=12.8$, $p<0.001$), condition and age group ($X^2=17.8$, $p<0.001$), and condition and exposure to energy drink marketing channels ($X^2=13.4$, $p<0.001$). Females were more likely than males to perceive the sports-themed ad as promoting use of CEDs during sports ($B=0.88$, $p<0.001$), relative to the control ad. Respondents aged 12-14 and 15-17 were more likely to perceive the sports-themed ad as promoting use of CEDs during sports compared to respondents aged 18-19 ($B=1.34$, $p=0.001$, and $B=1.36$, $p<0.001$, respectively) and 20-24 ($B=0.91$, $p=0.008$, and $B=0.93$, $p=0.006$, respectively), relative to the control ad. Respondents who reported a greater number of channels of exposure to CED marketing were more likely to perceive the sports-themed ad as promoting use of CEDs during sports ($B=0.16$, $p<0.001$), relative to the control ad.

As shown in Figure 2B, there was no significant difference between conditions in perceiving the ad as promoting use of CEDs with alcohol ($X^2=0.001$, $p=0.98$).

Experiment 3

The results from experiment 3 are presented in Figure 3 and Supplementary Table 3. The majority of respondents perceived each ad as targeting people their own age. Among respondents aged 12-14 and 15-17, 12.4% and 34.8%, respectively, reported that the party-themed ad targeted people their age or younger. Overall, there was no significant difference between conditions in perceiving a younger target audience ($X^2=2.9$, $p=0.09$).

As shown in Figure 3A, there was no significant difference between conditions in perceiving the ad as promoting use of CEDs during sports ($X^2=1.5$, $p=0.22$).

As shown in Figure 3B, there was a significant difference between conditions in perceiving the ad as promoting use of CEDs with alcohol ($X^2=408.3$, $p<0.001$): respondents were more likely to perceive the ad as promoting use of CEDs with alcohol if they viewed the party-themed ad (AOR=13.79; 95% CI 10.69, 17.78), compared to the control ad. In addition, there was a

significant interaction between condition and sex ($X^2=8.0$, $p=0.005$): females were more likely than males to perceive the party-themed ad as promoting use of CEDs with alcohol ($B=0.73$, $p=0.005$), relative to the control condition.

DISCUSSION

The current study indicates that youth and young adults perceive CED ads to be targeting people their age, with evidence that a substantial number of 12- to 14-year-old respondents perceived some ads to be targeting people their age or younger. This finding is consistent with previous related studies indicating that young people perceive CED ads as targeting a young demographic.^{38,39} It is evident that CED ads are perceived as targeting young people, despite regulations prohibiting marketing to children.¹⁵ While current regulations classify a child as 12 years and under, there is also debate as to what constitutes a 'child'. For example, consultations for Health Canada's proposed approach to restricting the marketing of unhealthy food and beverages to children found that many contributors supported the inclusion of those under 17 years in the definition of 'child'.⁴²

In addition, the current study clearly illustrates that youth and young adults perceive real CED ads to be promoting use of CEDs during sports and with alcohol, consistent with prior related studies.^{38,39} This finding was established in each of the three separate experiments. For example, across all experiments, the ads with sports themes were consistently perceived as promoting use of CEDs during sports, compared to the ads with only party themes or control ads. In general, females were more likely than males to perceive that the ads with sports themes promoted use of CEDs during sports. One possible explanation for this finding is that the sports-themed ad in one of the experiments predominantly featured females, which may have made it resonate more with female respondents. In addition, respondents who reported a greater number of channels of exposure to CED ads were more likely to perceive the sports-themed ad as promoting use of CEDs during sports relative to the control ad, which may be due to greater awareness and sensitivity to the content of ads. It may also be that this relationship

has to do with particular channels of exposure, such as sports sponsorship, which would contribute to the overall number of channels of exposure.

Similar to the findings for the sports-themed ads, ads featuring party themes were consistently perceived as promoting use of CEDs with alcohol, compared to ads with only sports themes or control ads. Overall, there were fewer interactions for ads with party themes. Though, similar to sports-themed ads, females were more likely to perceive the party-themed ads as promoting use of CEDs with alcohol. It may be that while females focused on the party themes of the ad and made connections to alcohol, males focused on other parts of the ads, including the multiple components (studying and practising) featured in the sports/party-themed ad A in experiment 1, and the bartender featured in the party-themed ad in experiment 3. It may also be possible that females were more involved and focused on the content in the survey; females have been shown to participate in online questionnaires more than males,⁴³ as well as accept a lesser incentive for their participation,⁴⁴ which may extend to their willingness to perform well in the survey, including reading, focusing, and responding to questions. Future research, including qualitative studies, should explore sex differences in ad perceptions. While there were no consistent findings for age group, younger respondents were more likely to perceive the sports/party-themed ad with cartoon images as promoting use of CEDs with alcohol, which may have been due to the general appeal of the ad style to younger audiences.

The findings also show specificity of responses to ad messaging, helping to address any study demand effects or social desirability bias. In experiment 2, where respondents viewed either a sports-themed ad or a control ad, perceptions of the ad promoting use of CEDs with alcohol was very low for both conditions. Likewise, in experiment 3, where respondents viewed a party-themed ad or a control ad, perceptions of ad messaging as promoting using CEDs during sports were similarly low.

Overall, the findings demonstrate that current regulations in Canada are not achieving their objectives. If the goal is to prevent consumption of CEDs by children, as well as use during

sports and with alcohol, then greater compliance to the current regulations or additional marketing restrictions are necessary. Other policy measures, such as increasing the price of the product, changing product packaging and restricting sales to children may also be effective. For example, UK supermarkets have recently banned sales of energy drinks to children under 16.⁴⁵

Limitations

The current study has limitations common to survey research. The sample was recruited through a web panel, and therefore was not probability-based, which may limit generalizability. Web panels pose issues such as self-selection bias, as members opt-in. Further, nonresponse, either in recruitment (non-contact, refusal, or unavailability) or through attrition, is usually prevalent with web panels. However, the sample included respondents in all provinces, and survey weights were applied to match national estimates for age, sex, and geographic region. The experimental design, as well as the use of three separate experiments and real ads were considerable strengths of the study. Although the main outcomes were based on self-report and were therefore subjective, this is the only way to assess ad perceptions.

Conclusions

Despite regulations in Canada prohibiting the marketing of CEDs to children, CED ads are still perceived as targeting young people, including those aged 12-14 years and younger. In addition, counter to regulations in Canada, ads are seen as promoting CEDs for use during sports and with alcohol. This is concerning given that the use of CEDs in these specific contexts is advised against, due to posing elevated risks. It is not surprising that associations are made between CEDs and their use during sports, as sports references in CED ads are explicit. In contrast, alcohol references in CED ads are less explicit, as they do not make direct references to alcohol, although they do show settings (such as parties and nightclubs) in which alcohol is commonly consumed. Our study, as well as research in other domains⁴⁶, demonstrates that implicit or indirect references are sufficient to promote associations between CEDs and their use in particular contexts.

TABLES & FIGURES

Table 1. Ads shown in each experiment

Experiment 1

Control condition



Sports/party-themed condition A



Sports/party-themed condition B



Experiment 2

Control condition



Sports-themed condition



Experiment 3

Control condition



Party-themed condition

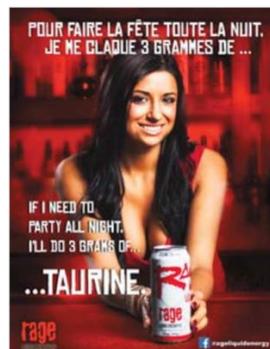
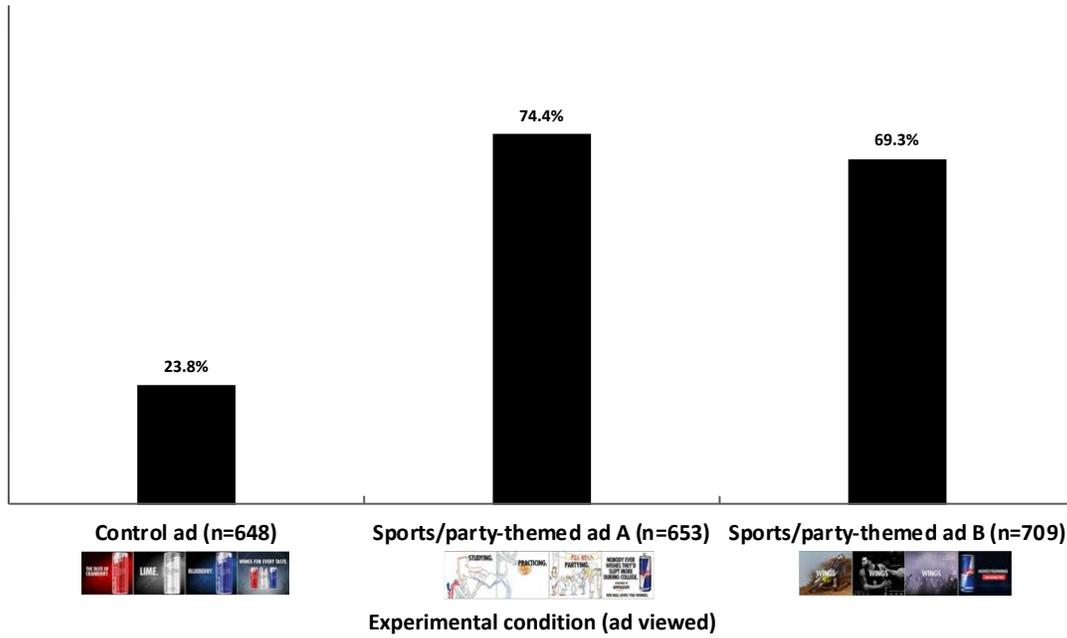


Table 2. Sample characteristics of respondents in analytic sample, unweighted and weighted (n=2,010)

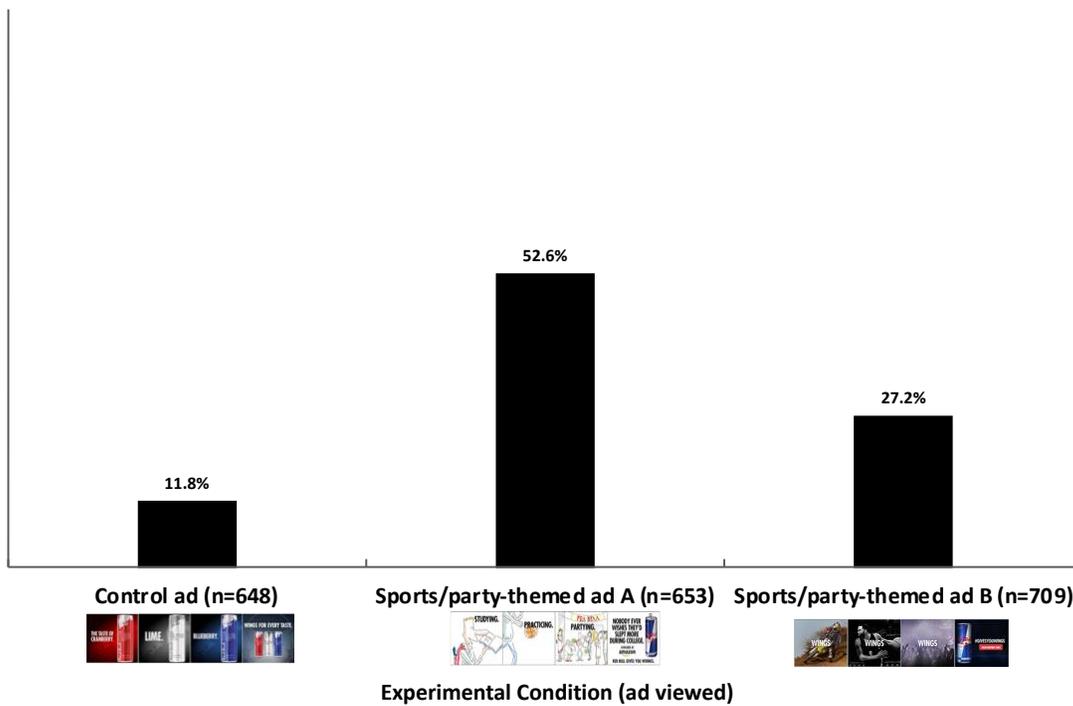
Characteristic	Unweighted % (n)	Weighted %
Sex		
Male	50.4% (1,013)	51.1%
Female	49.6% (997)	48.9%
Age group		
12-14	19.7% (396)	21.6%
15-17	30.4% (612)	23.8%
18-19	10.4% (209)	15.9%
20-24	39.5% (793)	38.7%
Language of survey		
English	60.3% (1,212)	77.9%
French	39.7% (798)	22.1%
Race/ethnicity		
White (only)	73.8% (1,484)	66.9%
Mixed/Other/DK/Refused	23.1% (464)	29.3%
Any Aboriginal	3.1% (62)	3.8%
Region		
British Columbia	7.4% (148)	12.9%
Prairies (AB, SK, MB)	13.1% (264)	18.4%
Ontario	31.0% (623)	39.8%
Quebec	43.3% (870)	22.7%
Atlantic (NB, NL, NS, PEI)	5.2% (105)	6.3%
Ever-use of energy drinks		
Yes	74.3% (1,493)	75.4%
No	25.7% (517)	24.6%
Marketing exposure index		
(mean; SD)	3.4; 2.9	3.4; 2.9

Figure 1. Experiment 1

A. Proportion of respondents who reported that ad promoted use of energy drinks during sports, by condition (advertisement) (n=2,010)



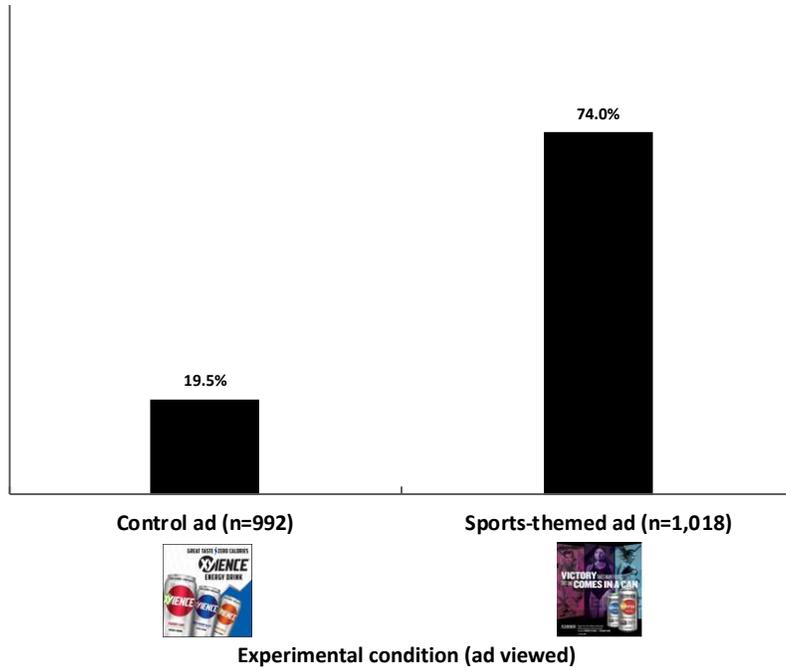
B. Proportion of respondents who reported that ad promoted use of energy drinks with alcohol, by condition (advertisement) (n=2,010)



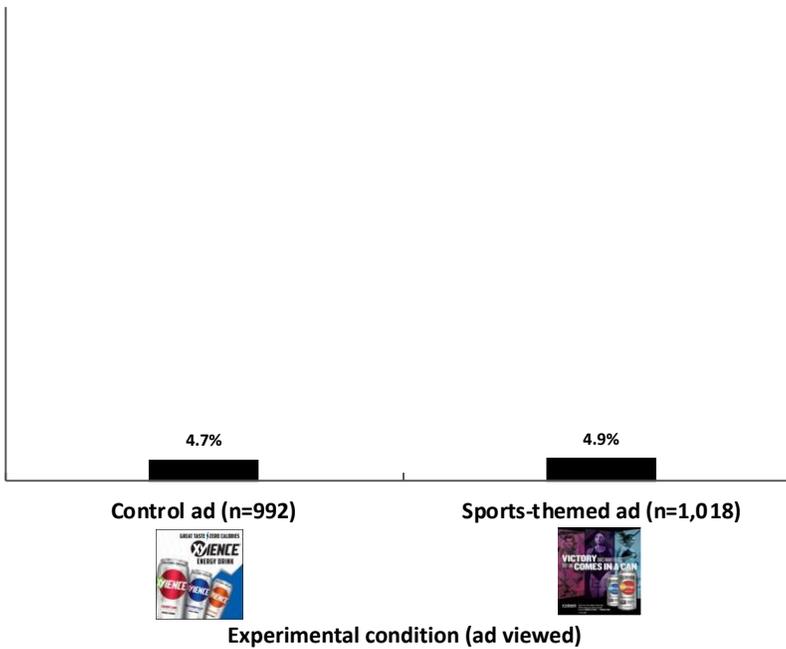
*'Don't know' and 'Refused' responses included in the denominator.

Figure 2. Experiment 2

A. Proportion of respondents who reported that ad promoted use of energy drinks during sports, by condition (advertisement) (n=2,010)



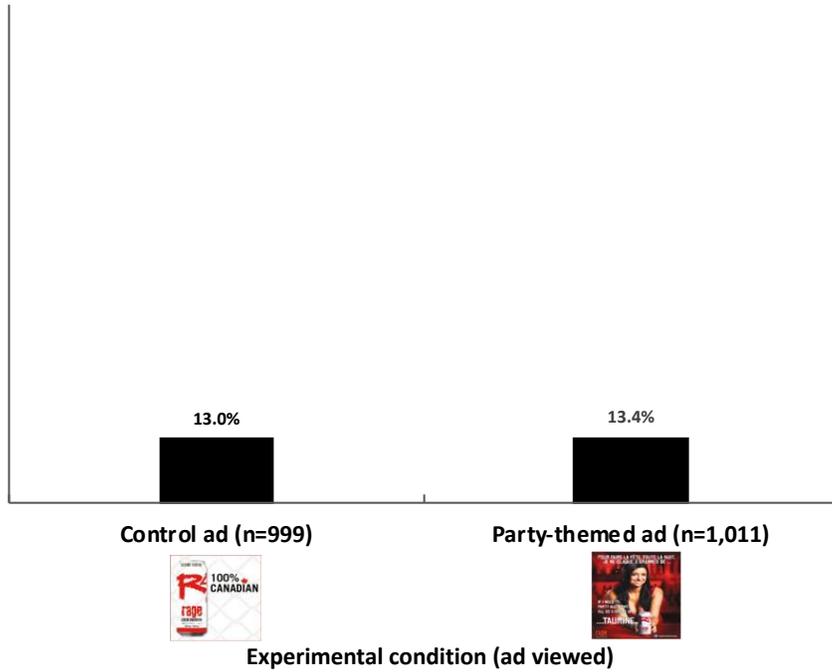
B. Proportion of respondents who reported that ad promoted use of energy drinks with alcohol, by condition (advertisement) (n=2,010)



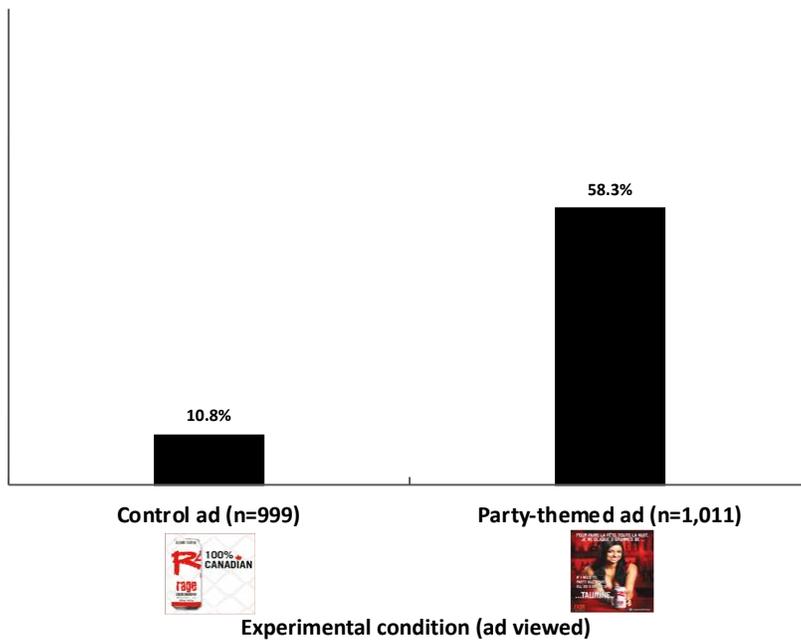
*'Don't know' and 'Refused' responses included in the denominator.

Figure 3. Experiment 3

A. Proportion of respondents who reported that ad promoted use of energy drinks during sports, by condition (advertisement) (n=2,010)



B. Proportion of respondents who reported that ad promoted use of energy drinks with alcohol, by condition (advertisement) (n=2,010)



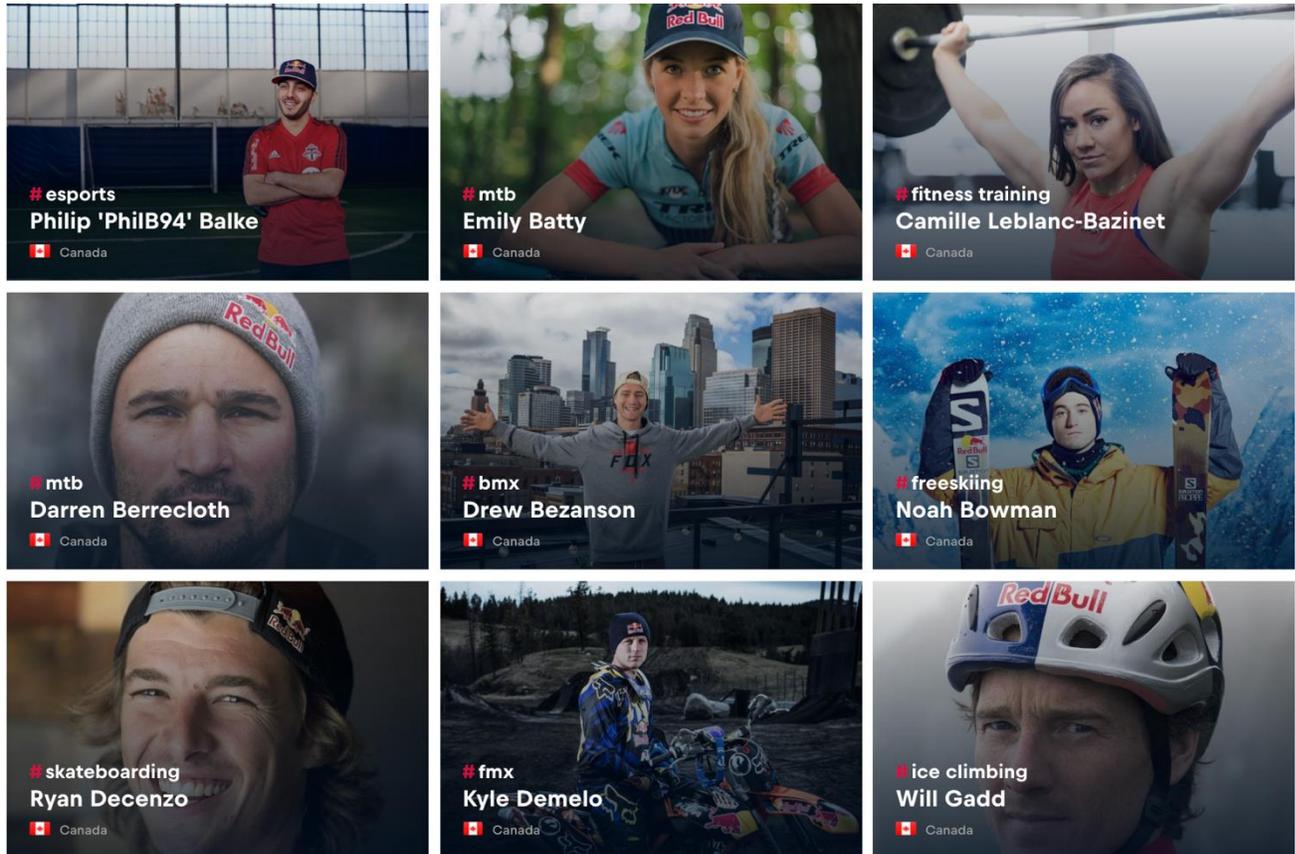
*'Don't know' and 'Refused' responses included in the denominator.

DISCUSSION

Overall, the results suggest that youth and young adults in Canada have high levels of exposure to CED marketing, combined with very low levels of exposure to educational messages that warn about the potential health risks of CEDs. In addition, CED ads are perceived to be targeting young people, as well as promoting use of CEDs during sports and with alcohol. Over 80% of respondents reported ever seeing marketing through at least one channel, with the most common sources of exposure being ads on TV, posters or signs in a convenience or grocery store, and ads online/on the internet, which is consistent with previous research.¹⁰⁴ Out of 10 possible sources of exposure, respondents reported exposure to an average of just under 4 channels. In addition, respondents had relatively high levels of exposure to the majority of channels indicating that marketing is reaching young people through a variety of channels, also consistent with prior research.^{104,105}

Those who were older, were ever-users of CEDs, were extreme sports viewers, or who were aware of mixing alcohol with energy drinks were more likely to report a greater exposure to CED marketing channels. Overall, these results make sense given that those who are older most likely have had higher exposure to ads in general. In addition, those who have had experience and awareness of CEDs and CED-related attributes such as extreme sports and mixing alcohol with energy drinks would also be expected to have a greater exposure to CED marketing channels, given that marketing is often featured alongside these attributes^{92,95}, and through multiple consumer targeted mediums. For example, Red Bull's website has many references to sponsored athletes (see Figure 1). It would be expected that those who have watch extreme sports would be familiar with athlete sponsorship and the associated marketing of energy drinks.¹²¹

Figure 1. Examples of athletes and sport sponsorships featured on Red Bull's website



Interestingly, sex was not associated with exposure to CED marketing, which is surprising given that CED marketing typically features content that is appealing to males.^{93,94} Our findings show that CED marketing is reaching both males and females. This finding may be due to the broad range of marketing channels that are being used to reach consumers, some of which may have similar reach among both males and females. For example, while traditional sources of marketing exposure like TV may be more prevalent on TV channels with an audience that is primarily males, digital sources of marketing exposure such as on the internet or on social media sites may have broader reach to a more diverse audience. In addition to sex, language, maternal education, and school grades were not significantly associated with exposure to CED marketing channels.

While exposure to CED marketing was high, the results also show that exposure to educational messages that warn about the potential health risks of CEDs is very low among youth and young adults in Canada. Only one third of respondents reported they had ever seen an educational message. Further, out of eight possible channels of educational message exposure, respondents reported an average exposure to less than one channel. To our knowledge, this is the first study to examine exposure to educational messages that warn about the potential health risks of energy drinks. Overall, the results are not surprising given that we are unaware of any comprehensive campaigns that educate consumers of the health risks associated with consuming CEDs. In contrast to marketing, if public health education campaigns have been implemented, they have been less prominent or visible. To illustrate, in a qualitative study conducted with young people aged 12-25 in Australia, many respondents were oblivious to even the cautionary statements provided on energy drink cans, suggesting that visibility of such messages needs to be increased.¹²² The respondents also suggested educational intervention strategies, among many other strategies, to reduce energy drink consumption, including implementing school visits and interactive educational sessions, having health messages show on news stories or television ads, educating parents, and developing practitioner-based strategies.¹²² Implementing educational strategies suggested by young people may help with their receptiveness to such interventions.¹²² Given that educational message interventions generally produce the most effective behaviour change outcomes when combined with other strategies,^{108,112} other components such as increasing the price, restricting sales to minors, changing product packaging, enforcing responsible marketing, and reducing visibility in retail outlets may also be warranted.¹²²

Respondents who were older, completed the survey in French, resided in Quebec, were extreme sports viewers, and had an awareness of mixing alcohol with energy drinks were more likely to report having seen an educational message. These findings make sense given that those who are older have most likely had more opportunities for exposure to education surrounding CEDs, among other health behaviours. It is unclear why speaking French and residing in Quebec are related to a greater exposure to educational messages surrounding

CEDs. While there have been educational campaigns surrounding sugar-sweetened beverages and CEDs in Quebec, a survey of educational campaigns in each region would be necessary to conclude why there may be greater exposure to educational messages in Quebec and among those who speak French. No consistent findings were found for maternal education. Sex and ethnicity were not associated with having seen an educational message.

Alongside high exposure to marketing and low exposure to educational messages, CED ads are perceived to be targeting young people, and promoting use of CEDs during sports and with alcohol. Overall, the majority of respondents reported that the energy drink ads across all themes targeted people their age. Further, a substantial number of 12- to 14-year-old respondents perceived some ads to be targeting people their age or younger. Although concerning, this finding is not surprising given that prior studies have shown that young people perceive CED ads to be targeting a young demographic.^{104,107} While current regulations classify a child as 12 years and under, there is also debate as to what constitutes a 'child'. For example, consultations for Health Canada's proposed approach to restricting the marketing of unhealthy food and beverages to children found that many contributors supported the inclusion of those under 17 years in the definition of 'child'.¹²³

In addition, the current study clearly illustrates that youth and young adults perceive that 'real' CED ads promote use of CEDs during sports and with alcohol, consistent with prior studies.^{104,107} This finding was established in each of the three separate experiments. For example, across all experiments, the ads with sports-themes were consistently perceived as promoting use of CEDs during sports, compared to the ads with the party-themes only or control ads. In general, females were more likely to perceive that the ads with sports-themes promoted use of CEDs during sports. One possible explanation that may add to the trend in this finding is that the sports-themed ad in one of the experiments featured predominately females, which may be more relatable to this group of respondents. In addition, respondents who reported a greater number of channels of exposure to CED ads were more likely to perceive the sports-themed ad as promoting use of CEDs during sports relative to the control ad, which may

be due to greater awareness and sensitivity to the content in ads. It may also be that this relationship has to do with particular channels of exposure, such as sports sponsorship, which would contribute to the overall number of channels of exposure.

Similar to the findings for the sports-themed ads, ads featuring party-themes were consistently perceived as promoting use of CEDs with alcohol, compared to ads with sports-themes only or control ads. Overall, there were less interactions for ads with party-themes. Though, similar to sports-themed ads, females were more likely to believe the party-themed ads promoted use of CEDs with alcohol. It may be that while females focused on the party themes of the ad and made connections to alcohol, males focused on other parts of the ads, including the multiple components (studying and practising) featured in the sports/party-themed ad A in experiment 1, and the bartender featured in the party-themed ad in experiment 3. It may also be possible that females were more involved and focused on the content in the survey; females have been shown to participate in online questionnaires more than males¹²⁴ as well as accept a lesser incentive for their participation,¹²⁵ which may extend to their willingness to perform well in the survey, including reading, focusing, and responding to questions. Future research, including qualitative studies, should explore sex differences in ad perceptions. While there were no consistent findings for age group, younger respondents were more likely to perceive that one of the party-themed ads with cartoon images promoted use of CEDs with alcohol, which may have been due to the general appeal of the ad to younger audiences.

The findings also show specificity of responses to ad messaging, helping to address concerns related to demand effects or social desirability bias. In experiment 2, where respondents viewed either a sports-themed ad or a control ad, perceptions of the ad promoting use of CEDs with alcohol was very low for both conditions. If a large proportion of respondents reported that either of these ads promoted use of CEDs with alcohol, this would raise concerns over the validity of the responses. If this were the case, respondents may be responding with 'yes' because they think that is the acceptable response. Likewise, in experiment 3, where respondents viewed a party-themed ad or a control ad, perceptions of ad messaging as

promoting using CEDs during sports were similarly low. Overall, having three separate experiments with the results being as expected, reduced any demand effects or social desirability concerns.

Overall, the findings demonstrate that current regulations in Canada are not achieving their objectives. If the goal is to prevent consumption of CEDs by children, as well as use during sports and with alcohol, then greater compliance to the current regulations or additional marketing restrictions are necessary. Other policy measures, such as increasing the price of the product, changing product packaging and restricting sales to children may also be effective. Other jurisdictions are implementing more restrictive regulations on energy drinks. For example, UK supermarkets have recently banned sales of energy drinks to children under 16.¹²⁶

STRENGTHS AND LIMITATIONS

The results from both studies have limitations common to survey research. The sample was recruited through a web panel, and therefore was not probability-based, which may limit generalizability. Web panels pose issues such as self-selection bias, as members opt-in. Further, nonresponse, either in recruitment (non-contact, refusal, or unavailability) or through attrition, is usually prevalent with web panels. Having a probability-based sample would have allowed for a representative sample of the Canadian population. However, the sample included all provinces, and survey weights were applied to match national estimates for age, sex, and geographic region. In Study 1, recall bias is a possibility with survey questions. Recall bias in questions related to marketing exposure and educational message exposure would have most likely led to underrepresentation of exposure and therefore conservative estimates, due to respondents forgetting they had seen a particular ad or educational message in the past. In addition, those who find certain ads relevant may be more likely to remember them, leading to selective recall. Though, the current findings are consistent with data showing that TV accounts for the majority of advertising expenditure for energy drinks⁹², as well as findings from previous research.¹⁰⁴

In Study 2, the experimental design and use of multiple experiments were considerable strengths of the study. Having three separate experiments, with the results being as expected, including significant differences between conditions, points to the idea that demand effects or social desirability bias did not occur. If demand effects or social desirability bias had occurred, the results would have likely been constant across conditions. Although the main outcomes were based on self-reported recall and were therefore subjective, this is the only way to assess ad perceptions. For example, in order to test what respondents perceived about the content in CED ads, they had to be asked directly. While the main outcomes were based on subjective responses and could therefore have variability, a large proportion of respondents had the same perceptions towards the ads shown. The use of 'real' ads was a strength of the study. While the experiments included forced exposure, rather than naturalistic exposure, which may cause respondents to respond in a different way, using real ads helped to support external validity of the results.

CONCLUSIONS

Findings from the current study indicate that exposure to CED marketing is prevalent among youth and young adults in Canada, significantly more so than exposure to educational messages that warn about the potential health risks of CEDs. Federal regulations, as well as industry's voluntary marketing codes, prohibit the marketing of CEDs to children; however, the current results, along with other previous studies, provides evidence that current policies are not achieving their objectives and CED marketing is reaching young people.^{92,93,100,104,105}

In addition, counter to regulations in Canada, ads are still perceived as promoting CEDs for use during sports and with alcohol. This is concerning given that the use of CEDs in these specific contexts is advised against, due to posing elevated risks. It is not surprising that associations are being made between CEDs and their use during sports, as sport references in CED ads are explicit. In contrast, alcohol references in CED ads are less explicit, as they do not make direct references to alcohol, although they do show settings (such as parties and nightclubs) in which alcohol is commonly consumed. Our study, and research in other domains,¹²⁷ demonstrates that implicit or indirect references are sufficient to promote associations between CEDs and

their use in particular contexts. Regulatory enforcement or amendments may help to address the ineffectiveness of current policies. In addition, while increasing education surrounding CEDs has been identified as a way to raise attention and awareness of CEDs, the current study reiterates that exposure to educational messages is low. Increasing education could be done in many ways including implementing large educational campaigns, incorporating education of CEDs in schools, as well as enhancing product warning labels. However, going forward, a comprehensive policy approach, as has been successful in reducing smoking prevalence, may be an effective approach in promoting lower-risk consumption of CEDs; this approach could involve educational messages, responsible marketing, increasing the price of the product, banning sales to minors, and increasing the visibility of cautionary labels on product packaging, among others.

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APPENDIX

MANUSCRIPT 2 SUPPLEMENTARY FILE

Table 1. Experiment 1: Perceived ad targets by condition/advertisement, overall and by age group, weighted % (n) (n=2,010)

	Experimental condition (ad shown)		
	Control condition	Sports/party-themed condition A	Sports/party-themed condition B
'What age group does this ad target?'			
Overall	n=648	n=653	n=709
People younger than me	13.9% (90)	13.8% (90)	12.0% (85)
People my age	62.3% (403)	63.1% (412)	65.0% (461)
People older than me	35.3% (229)	36.9% (241)	32.6% (231)
Don't know	10.1% (65)	3.7% (24)	5.8% (41)
Age 12-14 years			
People younger than me	4.0% (5)	4.2% (6)	4.3% (6)
People my age	28.9% (39)	25.1% (39)	28.8% (41)
People older than me	66.5% (90)	77.7% (121)	70.0% (100)
Don't know	11.6% (16)	5.3% (8)	6.3% (9)
Age 15-17 years			
People younger than me	11.7% (18)	7.2% (11)	6.3% (11)
People my age	48.5% (76)	51.9% (79)	48.7% (82)
People older than me	50.9% (80)	53.3% (81)	56.8% (96)
Don't know	14.2% (22)	5.2% (8)	5.4% (9)
Age 18-19 years			
People younger than me	10.1% (10)	13.1% (14)	4.1% (4)
People my age	81.7% (84)	87.3% (95)	83.4% (90)
People older than me	30.9% (32)	18.4% (20)	18.8% (20)
Don't know	8.9% (9)	1.9% (2)	5.7% (6)
Age 20-24 years			
People younger than me	22.2% (56)	24.8% (59)	22.0% (64)
People my age	80.9% (204)	84.2% (199)	85.4% (248)
People older than me	10.7% (27)	8.1% (19)	5.2% (15)
Don't know	7.3% (18)	2.5% (6)	5.7% (17)

*Percentages do not sum to 100, as respondents could select multiple responses. Refused responses included in the denominator.

Table 2. Experiment 2: Perceived ad targets by condition/advertisement, overall and by age group, weighted % (n) (n=2,010)

'What age group does this ad target?'	Experimental condition (ad shown)	
	Control condition	Sports-themed condition
		
Overall	n= 992	n=1,018
People younger than me	15.1% (149)	10.5% (107)
People my age	52.0% (516)	55.5% (565)
People older than me	35.4% (351)	46.3% (472)
Don't know	18.6% (184)	8.4% (85)
Age 12-14 years		
People younger than me	3.6% (7)	5.1% (12)
People my age	25.4% (52)	21.8% (50)
People older than me	54.5% (111)	73.2% (169)
Don't know	24.6% (50)	9.8% (23)
Age 15-17 years		
People younger than me	9.1% (22)	5.1% (12)
People my age	49.8% (121)	37.3% (88)
People older than me	41.8% (101)	63.0% (148)
Don't know	19.5% (47)	11.2% (26)
Age 18-19 years		
People younger than me	19.7% (32)	7.3% (12)
People my age	61.8% (100)	73.2% (115)
People older than me	31.9% (52)	41.6% (66)
Don't know	14.4% (23)	6.6% (10)
Age 20-24 years		
People younger than me	22.9% (88)	18.1% (71)
People my age	63.3% (243)	79.0% (312)
People older than me	22.6% (87)	22.6% (89)
Don't know	16.5% (64)	6.6% (26)

*Percentages do not sum to 100, as respondents could select multiple responses. Refused responses included in the denominator.

Table 3. Experiment 3: Perceived ad targets by condition/advertisement, overall and by age group, weighted % (n) (n=2,010)

Experimental condition (ad shown)		
	Control condition	Party-themed condition
'What age group does this ad target?'		
Overall	n=999	n=1,011
People younger than me	14.4% (144)	12.8% (130)
People my age	46.7% (467)	51.6% (522)
People older than me	38.9% (388)	49.8% (504)
Don't know	20.7% (207)	7.8% (79)
Age 12-14 years		
People younger than me	5.6% (13)	2.4% (5)
People my age	27.1% (64)	10.0% (20)
People older than me	60.1% (141)	84.8% (168)
Don't know	21.7% (51)	5.9% (12)
Age 15-17 years		
People younger than me	9.8% (24)	4.5% (11)
People my age	37.8% (91)	30.3% (72)
People older than me	49.5% (120)	72.5% (171)
Don't know	21.6% (52)	8.0% (19)
Age 18-19 years		
People younger than me	21.0% (29)	12.4% (22)
People my age	55.2% (77)	67.8% (122)
People older than me	27.2% (38)	46.3% (84)
Don't know	19.2% (27)	9.1% (16)
Age 20-24 years		
People younger than me	20.3% (78)	23.2% (92)
People my age	61.3% (235)	77.9% (308)
People older than me	23.3% (90)	20.3% (80)
Don't know	20.0% (77)	8.1% (32)

*Percentages do not sum to 100, as respondents could select multiple responses. Refused responses included in the denominator.

Figure 1. Experiment 1: 'Does this ad promote using these energy drinks during sports?': Interaction between Condition and Sex

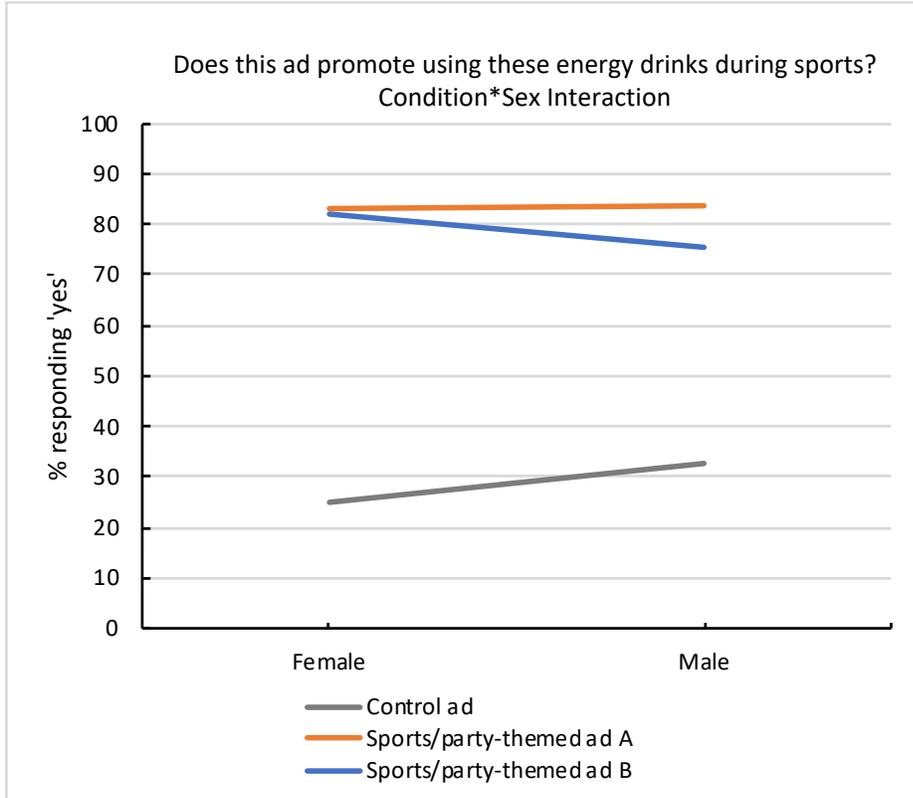


Figure 2. Experiment 1: 'Does this ad promote using these energy drinks during sports?': Interaction between Condition and Marketing exposure index

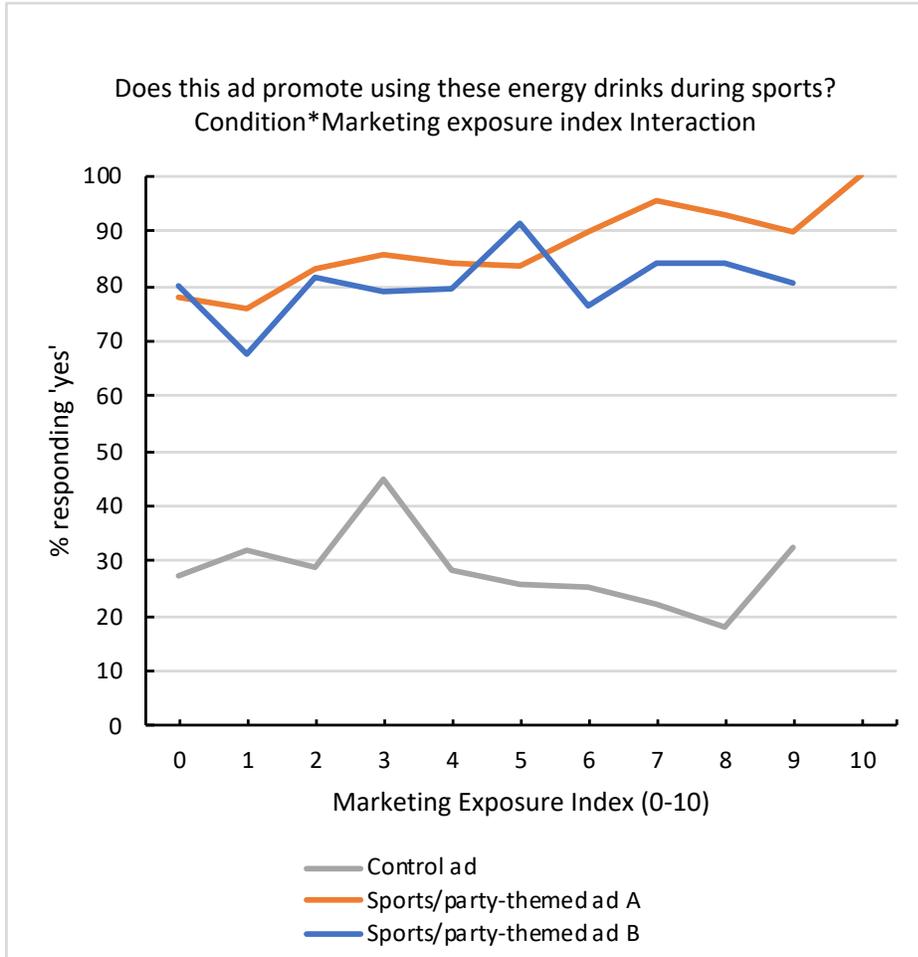


Figure 3: Experiment 1: 'Does this ad promote using these energy drinks with alcohol?': Interaction between Condition and Sex

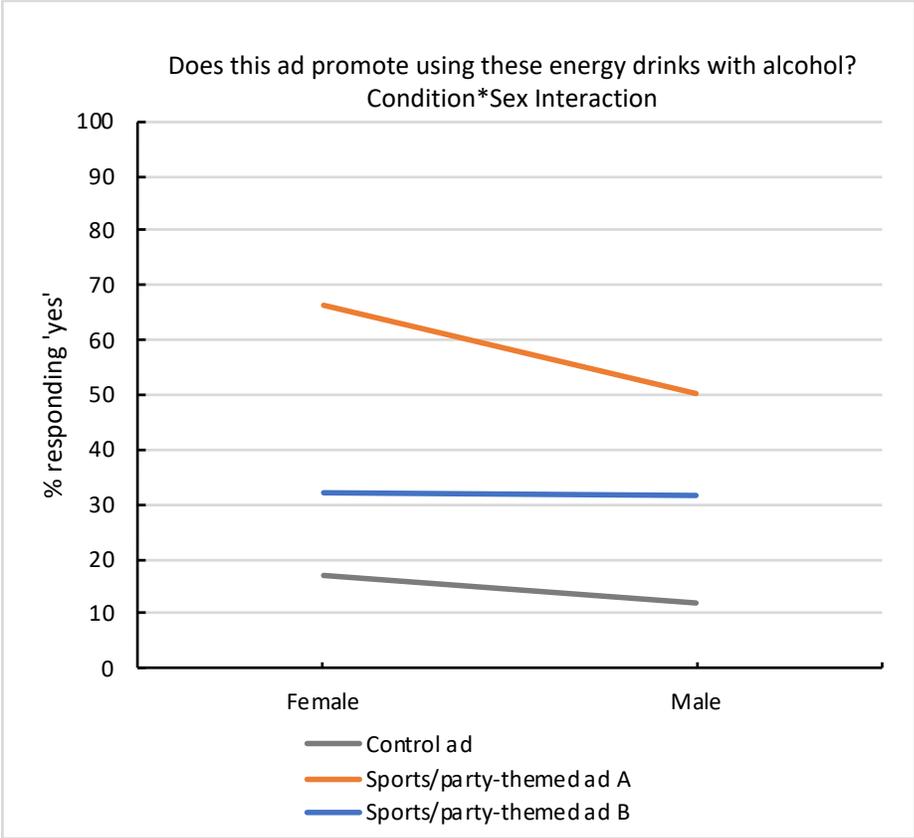


Figure 4: Experiment 1: 'Does this ad promote using these energy drinks with alcohol?': Interaction between Condition and Age

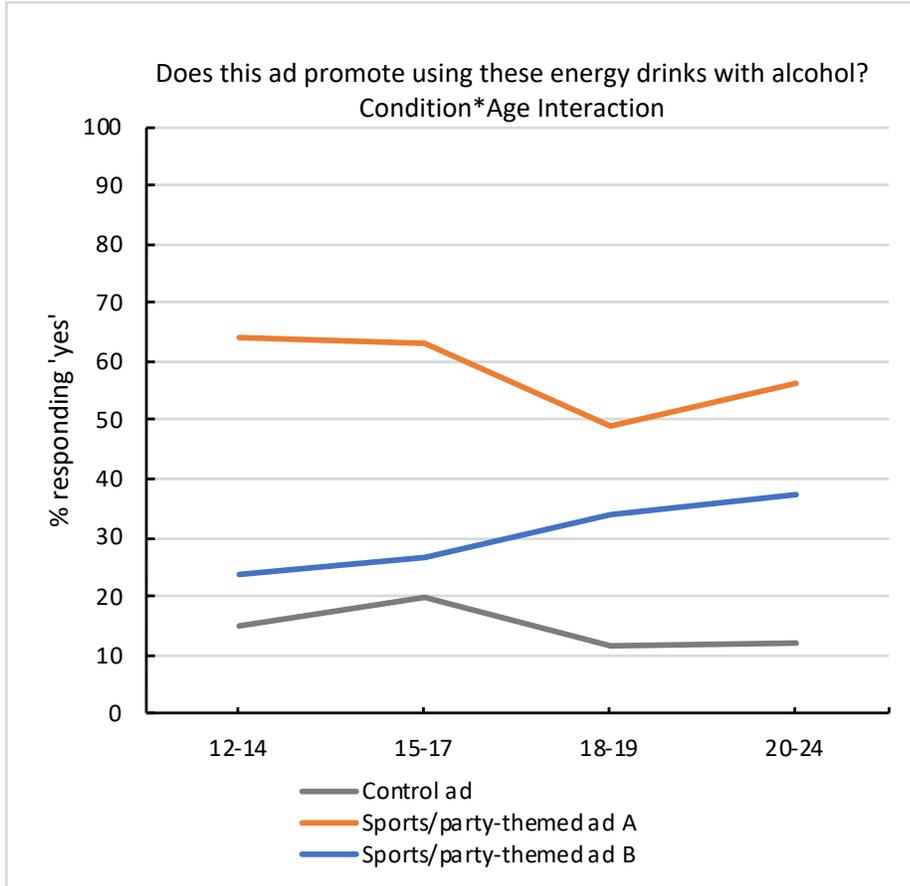


Figure 5: Experiment 2: 'Does this ad promote using these energy drinks during sports?': Interaction between Condition and Sex

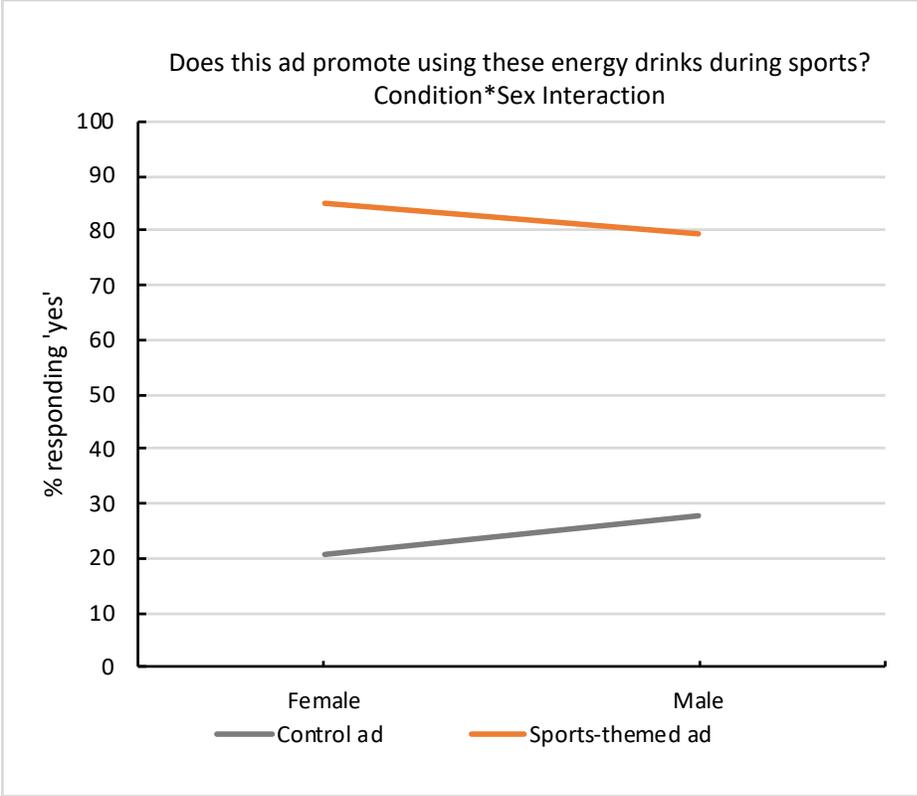


Figure 6: Experiment 2: 'Does this ad promote using these energy drinks during sports?': Interaction between Condition and Age

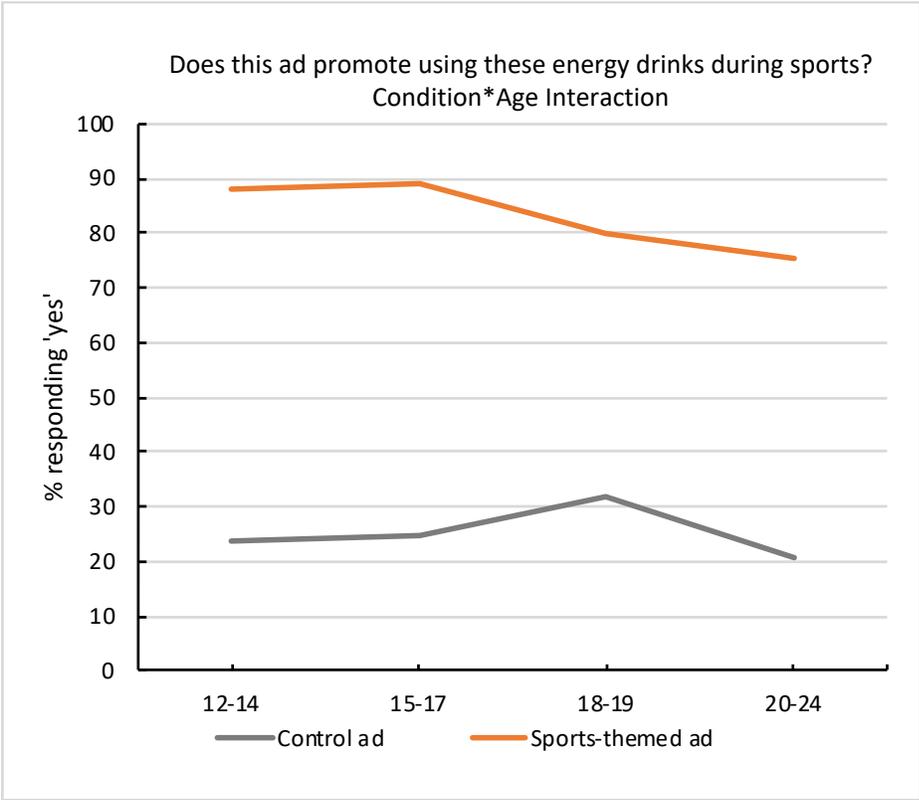


Figure 7: Experiment 2: 'Does this ad promote using these energy drinks during sports?': Interaction between Condition and Marketing exposure index

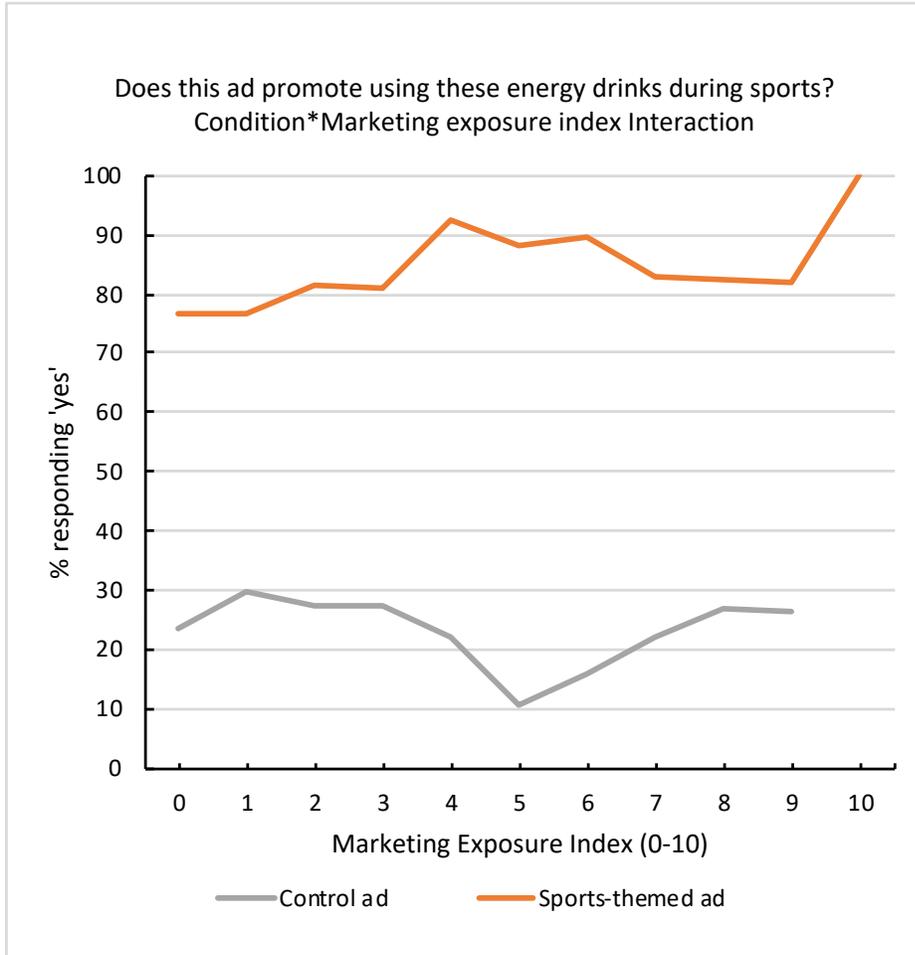


Figure 8: Experiment 3: 'Does this ad promote using these energy drinks with alcohol?': Interaction between Condition and Sex

