



Alcohol social media marketing and drinking behaviors among Chinese young adults: Mediation by drinking expectancies

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ABSTRACT

Aims: Exposure to alcohol content on social media has been linked to increased alcohol consumption, but data are scarce regarding the pathway of these associations. This study aims to examine the association between levels of alcohol social media marketing (SMM) exposure with positive drinking expectancies and whether these expectancies mediate recent drinking behaviour and future drinking intentions.

Methods: An anonymous, random telephone survey was conducted between June to August 2021 on Hong Kong Chinese residents between 18 and 34 years old ($n = 675$). The study used the Chinese Drinking Expectancy Questionnaire (CDEQ-Adult) to measure drinking-related beliefs. The association between alcohol SMM with drinking behaviour outcomes was assessed with multivariable logistic regression. The study assessed the mediation of the mentioned association by drinking expectancy using the PROCESS macro (version 4.0).

Findings: Past month exposure to alcohol SMM was significantly associated with all drinking behaviours (OR_{mv} ranged from 1.93 to 7.85). The Total CDEQ-Adult positive expectancies score showed statistically significant mediation effects on all drinking behaviours except for future intention to drink to intoxication (Indirect effect: 0.08–0.19). Mediation analysis performed with subscales showed that Interpersonal Benefits, Increased Confidence, and Tension Reduction expectancies mediated the association between SMM exposure and drinking behaviours while Health Benefits and Negative Consequences did not.

Conclusions: The noted associations between alcohol SMM drinking behaviours may be partly explained by drinking expectancies. The study findings provide information regarding the mechanisms through which SMM influences drinking behaviors. It may be necessary to counter-balance these types of advertising messages targeting young people.

1. Introduction

The international literature strongly suggests that exposure to alcohol marketing increases drinking levels (Jernigan, 2009; Grenard et al., 2013; Smith and Foxcroft, 2009). Alcohol marketing has traditionally included print and radio advertisements as well as event sponsorship; however, over the past two decades, there has been a dramatic increase in social media marketing (SMM) by the alcohol industry. By 2023, \$7.7 billion per year was being spent on SMM by the global alcohol industry (Zenith Global, 2021). SMM on social media sites such as Facebook and Instagram, include algorithm-based, business-to-consumer marketing such as banner advertisements and suggested links to

corporate account pages. Alcohol SMM, however, also employs viral marketing strategies by encouraging consumer-to-consumer sharing of alcohol SMM posts with their online contacts. Those on social media may even create their own alcohol brand-related social media pages where they can upload pictures, blog, or form interest groups.

Drinking expectancies, or the perceived positive (e.g., relaxation) and negative (e.g., hangover) consequences of consuming alcohol, can be formed from direct personal experience or through the observation of others (Fromme and D'Amico, 2000 Jun). Alcohol advertising has been shown to foster favourable alcohol-related attitudes and perceptions, which in turn, can predict positive drinking expectancies (Smit et al., 2018; Wills et al., 2009; Christiansen et al., 1989). Previous research has

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shown that positive drinking expectancies mediate the relationship between exposure to traditional alcohol advertising and alcohol drinking behaviours (Cin et al., 2009; Osberg et al., 2012; Frederick and Jang, 2013; Fleming et al., 2004). Studies with adolescents (Cin et al., 2009) and college freshmen (Osberg et al., 2012) have shown that exposure to alcohol content in films influences consumption through both positive and negative expectancies. One other study noted that alcohol advertising's effects on intention to drink were mediated by positive drinking expectancies (Frederick and Jang, 2013). Unlike traditional forms of alcohol advertisement, recipients of alcohol SMM often share, "tag", and "like" posted content. This form of content sharing can thereby exert additional influence on young adults' drinking expectancies as a form of peer endorsement (Smith and Foxcroft, 2009). Given the growth of alcohol SMM, and the potentially large influence of this form of alcohol marketing, there is a dearth of studies on the influence of alcohol SMM on drinking behaviours (Bruijn et al., 2012; Chen et al., 2017; Dumbili and Henderson, 2017). Studies conducted on young children and adolescents have shown that drinking expectancies mediate the relationship between various forms of alcohol marketing exposure and drinking behaviour (Bruijn et al., 2012; Chen et al., 2005; Grube and Waiters, 2005). As youngsters are particularly susceptible to the persuasive advertising messages, turning themselves into lifetime customers (Grenard et al., 2013). Yet, this is not as clearly demonstrated in young adults (Fleming et al., 2004). Young adults who are more likely to have drinking experience and may react to mass media advertising differently from their younger age counterparts who have not yet initiated drinking, particularly in non-western populations (Wyllie et al., 1998).

In emerging alcohol markets such as China, drinking is increasingly becoming a normative lifestyle activity among young adults, who are a key risk group for harmful use of alcohol. In Hong Kong, a high-income Chinese city with a high degree of alcohol accessibility (Hong Kong Government, 2008; Hong Kong Commerce and Economic Development Bureau, 2010), the most recent data indicate that the 25–34 age group had the highest proportion of past-year alcohol use and binge drinking, facing a heightened risk of various alcohol-related harms (Hong Kong Government, 2015; Chung et al., 2013; Kim et al., 2009; Yu et al., 2022a; Lau et al., 2005). Although young adults are not the age group most likely to drink and drive in Hong Kong, it has noted that approximately 7.5 % of adults between 18 and 35 self-reported past-year drink driving (Kim et al., 2010, 2013). There has been increasing levels of alcohol consumption with a concomitant rise in alcohol marketing in these regions (World Health Organization, 2018; Hao and Young, 2000; Cochrane et al., 2003). A previously conducted study by the authors have also noted that alcohol SMM posts on Facebook increased dramatically over a 10-year period in the region and that alcohol SMM has adapted their content to the local drinking culture (Chan et al., 2022). As a high proportion of young adults in Hong Kong have had exposure to alcohol SMM (Chan et al., 2023), this study can further our understanding of the impact of exposure to alcohol advertisement on young adult drinking expectancy and behaviours.

This study will examine the associations between alcohol SMM, drinking-related expectancies and drinking behaviours in Hong Kong, a region that is characterized by high accessibility of alcohol, no import duties on beer and wine, and virtually no regulation of alcohol SMM. This study aims to examine whether there is an association between levels of alcohol SMM exposure with positive drinking expectancies and whether these expectancies mediate recent drinking behaviour and future drinking intentions.

2. Methods

2.1. Study design

We conducted a cross-sectional study, i.e., an anonymous telephone survey was conducted between June to August 2021 among fixed-line telephone numbers in Hong Kong. Currently, Hong Kong has a fixed-

line penetration rate of about 84 % (Office of the Telecommunications Authority, HKSAR, 2022).

2.2. Study participants and sample size calculation

Our study participants included residents at the address of the fixed-line telephone number. Our inclusion criteria were: 1) ability to speak colloquial Cantonese language; 2) age between 18 and 34 years. Given an estimated proportion conservatively assumed to be 0.5 with a 3.75 % margin of errors, and $z = 1.96$ of 95 % confidence interval, a sample size of 675 is needed.

2.3. Study instrument

Our study instrument was a structured survey interview questionnaire written in colloquial Cantonese. The CDEQ-Adult was previously developed as a culturally relevant instrument for assessing drinking expectancies in Chinese young adults (Chan et al., 2024). The instrument was developed from a literature review and focus group analysis, followed by exploratory and confirmatory factor analysis (EFA and CFA) of Chinese young adults in Hong Kong. The EFA yielded a 31-item, five-factor model: 1) Negative consequences of drinking; 2) Interpersonal social/business benefits; 3) Increased confidence; 4) Health benefits of drinking, and; 5) Tension reduction (variance explained = 63.7 %) and the CFA showed a good fit for the model (Chan et al., 2024). The Cronbach's α coefficient of the above 5 domains were 0.94, 0.90, 0.86, 0.77, and 0.57, respectively ($n = 675$). We used the CDEQ-Adult to measure drinking expectancies. We developed and validated the CDEQ-Adult instrument specifically for young adults (Chan et al., 2024). Respondents rated each expectancy item on a 5-point Likert scale of 1 = *strongly disagree* to 5 = *strongly agree*. We calculated a summative score from the responses for each of the five domains (Lee et al., 2003). We also computed a separate CDEQ-Adult positive expectancies only score by excluding the domain of Negative consequences of drinking.

2.4. Study variables

Exposure (exposure to direct alcohol social media marketing, "SMM"): We asked participants about their past exposure to alcohol SMM within one month prior to the survey. The past-month time frame was used to reduce recall error and misclassification of alcohol SMM exposure levels. The alcohol SMM exposures were divided into: 1) *direct* alcohol SMM exposure (e.g. did the respondent original postings from alcohol brands on social media sites, did the respondent see banner advertisements on sites such as Facebook or ads on websites such as Youtube); 2) exposure to *indirect* alcohol SMM (e.g. exposure by "shared" or "liked" or "commented" alcohol posts on sites like Facebook from by their online social network, did the respondent see people you follow on social media post photos/videos of themselves drinking a branded alcohol product). Response choices were: never in the past month (0 points), once or twice in past month (1 point) and three or more times (2 points). We then created summative scales from the number of affirmative responses to each question item.

Outcome (alcohol use behaviors): We asked participants about their lifetime history of alcohol, past-year history of alcohol consumption, and past-month history of binge-drinking (defined as consuming 5 + servings of alcohol within 2 h for men, and 4 + servings for women). The study assessed risky alcohol consumption with the 4-items CAGE questionnaire (Bernadt et al., 1982). In addition to alcohol-related behaviors, we also asked participants regarding their plan to drink or drink to intoxication in the coming month. Each of the drinking-related variables were coded in a binary manner (yes=1, no=0).

Demographic, socioeconomic, and other alcohol-related characteristics: During the survey interview, we also asked participants about their gender, age, education level, marital status, employment status, and

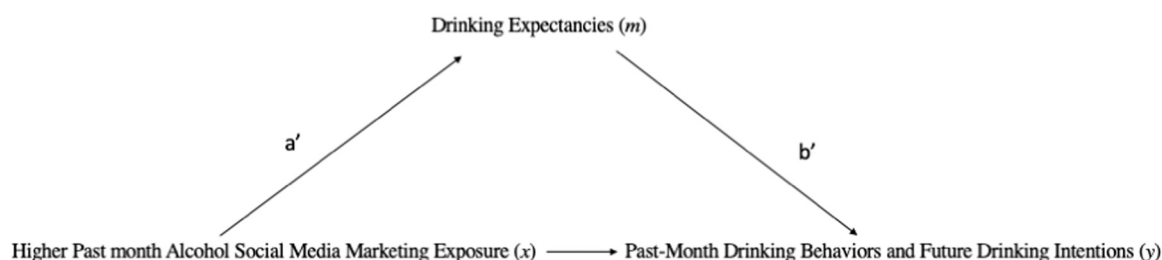


Fig. 1. Conceptual diagram of the simple mediation model.

household monthly income. We also measured the participants' knowledge about alcohol (minimum drinking age, alcohol labelling requirement, and standard alcohol unit), exposure to traditional alcohol

marketing (e.g., exposure to TV ads, print/mass media promotions).

2.5. Data collection and management

Random telephone numbers were generated from up-to-date telephone directories. For unanswered calls, at least 4 other independent calls were made on different hours and at different days, before considering the number to be invalid. If there were more than one eligible person, one would be randomly selected using the 'last birthday method' and invited to join the study. The telephone survey lasted approximately 10 min and no incentives were given to the participants. Verbal informed consent was obtained from the participants. The researcher was responsible for monitoring and reporting the progress on a weekly basis and a research assistant was responsible for data entry. The researcher performed initial validation during data collection and data entry.

2.6. Data analysis

We used descriptive statistics to present the characteristics of the study participants. We assessed the extent to which SMM exposure was associated with drinking outcomes using multivariable logistic regression analyses with backward elimination. We included sociodemographic factors and exposure to traditional alcohol marketing as potential confounders in the multivariable model if they met the cut-off of $p < 0.20$ in unadjusted analyses (Hosmer and Lemeshow, 2000). We conducted all analyses at 95 % level of confidence using IBM SPSS v24 (Corp, 2016).

We assessed the potential mediation effects of drinking expectancies (m) on the relationship between higher social media marketing exposure levels (x) and drinking behaviours (y) (Baron and Kenny, 1986) using the PROCESS macro (version 4.0) software (Hayes, 2017), which allows for non-continuous outcome variables. The model used in the current study specifies a single mediator causally located between X and Y and therefore a simple mediation model is used to test the mediation only effect. The model assumes the absence of unmeasured confounders between the mediator and the outcome. We presented the estimated effects in form of regression coefficient and its bootstrapped estimated 95 % CIs. The bootstrap (Efron and Tibshirani, 1994) is commonly used to obtain standard errors (SEs) and bias-corrected confidence intervals (CIs) for the indirect effect in mediation analysis to obtain more accurate confidence limits (MacKinnon et al., 2004). The indirect effect is tested using non-parametric bootstrapping. If 0 falls outside the confidence interval, then the indirect effect is inferred to be non-zero. The indirect effect (IE) is the product of regression coefficients a and b (see Fig. 1).

2.7. Research ethics approval

Ethics approval was obtained from the university sponsoring the project (Reference No. SBRE-19-239).

Table 1
Demographics of the telephone survey respondents ($n = 675$).

Demographic characteristics	Study Sample % (N)	2019 Census population %
Gender^a		
Male	49.48 % (334)	49.27 %
Female	50.52 % (341)	50.73 %
Age^b		
18–24	32.44 % (219)	33.47 %
25–29	29.63 % (200)	31.19 %
30–34	37.93 % (256)	35.34 %
Education level^c		
Less than university	48.15 % (325)	53.89 %
University or higher	51.9 % (350)	46.11 %
Marital status^d		
Married/ Separated/divorced/others	27.70 % (187)	30.34 %
Single	72.30 % (488)	69.66 %
Employment^e		
Non-employed/students/ housewife/ others	30.81 % (208)	25.21 %
Employed	69.19 % (467)	74.79 %
Household monthly income (HKD)^f *		
Under 40,000	50.8 % (325)	52.80 %
40,000 or above	49.2 % (315)	47.20 %
Drinking behaviours & knowledge		
Drinking patterns		
Lifetime ever alcohol consumption	80.1 % (541)	NA
Past-year alcohol consumption	53.0 % (358)	NA
Past-month binge drinking	12.4 % (84)	NA
Weekly drinking	3.7 %	NA
Risky drinking (using CAGE)	3.9 %	NA
Alcohol knowledge		
Familiar with minimum drinking age	93.2 % (629)	NA
Familiar with alcohol labelling requirement	89.6 % (605)	NA
Familiar with standard alcohol unit	13 % (88)	NA
Alcohol marketing exposure[†]		
Traditional alcohol marketing		
Exposed in the past month	71.6 % (483)	NA
Non-exposed	28.4 % (192)	NA
Alcohol Social Media Marketing		
Exposed in the past month	53.0 % (358)	NA
Non-exposed	47.0 % (317)	NA

^a, ^{c-f} Negligible effect size (Cohen's $h = 0.004, 0.116, 0.058, 0.125, 0.040$ respectively); ^b Negligible effect size (Cohen's $w = 0.055$); * $n = 640$ due to missing data. [†] Percentage of respondents who were exposed to traditional versus SMM alcohol marketing is measured using Chi-square (p -value < 0.001).

Table 2

Associations of higher past-month alcohol SMM exposure levels on drinking behaviour (n = 675).

	Adjusted Odds Ratio ^a					
	Past month drinking	Weekly drinking	Future intention to drink	Past-month binge drinking	Risky drinking (CAGE)	Future intention to drink to intoxication
Higher levels (>IQR) of past-month exposure to alcohol SMM	1.93 (1.28–2.90)‡	2.63 (1.16–5.95)†	4.85 (3.09–7.61)§	3.84 (2.37–6.23)§	3.49 (1.46–8.39)‡	7.85 (1.68–36.6)‡
Exposure to traditional media marketing	2.13 (1.21–3.74)‡	3.35 (0.73–15.4)	2.21 (1.13–4.32) †	–	1.63 (0.49–5.38)	–
Gender						
Female	1.00	–	1.00	1.00	–	–
Male	1.37 (0.92–2.03)	–	1.31 (0.86–1.99)	1.24 (0.76–2.02)	–	–
Age						
30–34	1.00	–	1.00	1.00	1.00	–
25–29	2.56 (1.56–4.19)§	–	1.43 (0.82–2.49)	1.81 (0.97–3.38)*	0.22 (0.05–1.08) *	–
18–24	1.29 (0.78–2.18)	–	0.97 (0.55–1.74)	0.95 (0.48–1.90)	0.82 (0.29–2.25)	–
Education level						
<University	1.00	–	1.00	1.00	–	1.00
University +	2.02 (1.33–3.06) ‡	–	2.15 (1.37–3.38)‡	1.61 (0.95–2.74)*	–	1.98 (0.48–8.09)
Marital status						
Married/cohabitate	–	–	1.00	–	–	–
Single	–	–	1.22 (0.73–2.04)	–	–	–
Employment						
Non-employed	–	–	–	1.00	1.00	–
Employed	–	–	–	0.57 (0.35–0.93)†	0.33 (0.14–0.78)†	–
Household income						
HKD 40 K+ /month	–	1.00	–	–	1.00	1.00
< HKD \$40 K/month	–	2.14 (0.86–5.29)	–	–	8.36 (1.91–36.59) ‡	2.32 (0.60–8.89)

CI, confidence interval; OR, odds ratio. *P < 0.10; †P < 0.05; ‡P < 0.01; §P < 0.001; –: the variable did not meet the p < 0.20 threshold for inclusion as a candidate variable for the backwards multiple regression model. For the multiple regression model, Odds Ratio (95 % CI) are shown for non-significant candidate variables prior to being dropped from the final multiple regression model.

^a AOR, adjusted odds ratio derived from stepwise multivariable logistic regression using univariable significant level P < 0.20 as candidate variable.

3. Results

A total of 675 Hong Kong residents were included in this cross-sectional study (response rate = 63 % out of 1072 contacted individuals, with less than 1 % interview non-completion rate). The study sample was generally representative of the Hong Kong Census population of that same age group (Census and Statistics Department, 2021) (Table 1). However, our sample has a slightly higher proportion of university-educated young adults (51.9 % vs. 46.1 %) and lower proportion of employed individuals (69.2 % vs 74.8 %). The study noted that more young adults were exposure to traditional alcohol marketing (71.6 %) in the past month than through SMM (53 %) (p < 0.001). In our sample, 12.4 % of the young adults reported past-month binge drinking, slightly increased levels than the levels reported in a 2010 survey (7.4 % in 18–24 age group, and 9.0 % in 25–34 age group) (Surveillance and Epidemiology Branch, Centre for Health Protection, 2011).

3.1. Correlation between exposure to alcohol SMM and drinking-related variables

The multivariable models shown in Table 2 found that higher levels of past month exposure to alcohol SMM was significantly associated with all drinking behaviours, even after the inclusion of confounding factors. The OR_{mv} ranged from 1.93 for past month drinking to 7.85 for future intention to drink to intoxication. By contrast, exposure to traditional alcohol marketing was only associated with past month drinking (OR_{mv} 2.13; 95 % CI: 1.21, 3.74; p < 0.01) and future intention to drink (OR_{mv} 2.21; 95 % CI: 1.13, 4.32; p < 0.05) but not with other drinking-related variables. In addition, higher educational attainment was significantly associated with past month drinking (OR_{mv} 2.02; 95 % CI: 1.33, 3.06; p < 0.01) and future intention to drink (OR_{mv} 2.15; 95 % CI: 1.37, 3.38; p < 0.01). Employed respondents were less likely to binge

drink (OR_{mv} 0.57; 95 % CI: 0.35, 0.93; p < 0.05) or experience risky drinking (OR_{mv} 0.33; 95 % CI: 0.14, 0.78; p < 0.05) while those with a monthly household income under HKD 40,000 were more likely to report risky drinking (OR_{mv} 8.36; 95 % CI: 1.91, 36.6; p < 0.01). Age was only associated with past month drinking (OR_{mv} 2.56; 95 % CI: 1.56, 4.19; p < 0.001 for 25–29-year-olds as compared with 30–34-year-olds). Gender and marital status were not independently associated with any of the drinking-related variables.

3.2. Drinking expectancies

The association between high exposure levels of alcohol SMM with CDEQ-Adult total score, CDEQ-Adult positive expectancies only score (excluding Negative consequences expectancy domain), and each expectancy domain score is shown in Table 3. After adjustment for various background factors, it was noted that higher past-month alcohol SMM was not significantly associated with higher CDEQ-Adult total score but was significantly associated with higher CDEQ-Adult positive expectancies only score. Higher levels of alcohol SMM was also independently associated with higher scores of the Interpersonal benefits, Increased confidence, and Tension reduction subscales of the CDEQ but was not associated with Health benefits subscale score or the Negative consequences subscale score.

3.3. Mediation analysis

Table 4 shows the estimates for: (a) the effect of higher past month alcohol SMM exposure levels on drinking expectancy scores (x on mediator), (b) the drinking expectancy scores on drinking-related outcome variables (mediator on y), (c) the direct effect of higher alcohol SMM exposure on the drinking behaviour outcomes (x on y), and (d) the indirect effect of alcohol SMM (x) through the drinking expectancy (mediator) on the drinking behaviour outcome (mediator-x on y).

Table 3
Effect of higher alcohol SMM exposure on drinking expectancies (n = 675).

	Unstandardized β (95 % CI)	Standardized β	p-value
Total CDEQ instrument score (min-max: 31–155)			
Higher levels of alcohol SMM exposure	1.67 (−0.43–3.77)	0.06	NS
Married /co-habituating/ others (vs Single)	3.61 (1.35–5.87)	0.12	0.002
Monthly household income < 40 K HKD (vs 40 K+)	3.14 (1.12–5.16)	0.12	0.002
<u>CDEQ score (4 positive expectancy domains only)</u>			
Higher levels of alcohol SMM exposure	2.98 (1.23–4.75)	0.14	0.001
Married /co-habituating/ others (vs Single)	2.87 (1.03–4.72)	0.12	0.002
Monthly household income < 40,000 HKD (vs 40 K+)	2.81 (1.06–4.56)	0.13	0.002
Upper secondary educated (vs University educated)	1.86 (0.05–3.67)	0.09	0.044
Employed (vs. Non-employed)	2.48 (0.59–4.37)	0.11	0.010
<u>Negative Consequences Expectancy Domain Score</u>			
Higher levels of alcohol SMM exposure	−0.77 (−1.97–0.44)	−0.05	NS
Age 25–29 (vs 30–34 year olds)	−1.49 (−2.68–0.29)	−0.09	0.015
Exposure to traditional marketing	−1.39 (−2.60–0.19)	−0.09	0.024
<u>Interpersonal Benefits Expectancy Domain Score</u>			
Higher levels of alcohol SMM exposure	1.23 (0.37–2.09)	0.11	0.005
Married /co-habituating/ others (vs Single)	1.26 (0.32–2.20)	0.11	0.009
Upper secondary educated (vs University educated)	1.24 (0.40–2.08)	0.12	0.004
Male (vs Female)	0.95 (0.10–1.80)	0.09	0.028
Age 25–29 (vs 30–34 year olds)	1.43 (0.52–2.35)	0.12	0.002
<u>Increased Confidence Expectancy Domain Score</u>			
Higher levels of alcohol SMM exposure	1.60 (0.89–2.31)	0.17	< 0.001
Married /co-habituating/ others (vs Single)	1.64 (0.86–2.41)	0.16	< 0.001
Monthly household income < 40 K HKD (vs 40 K+)	2.41 (1.70–3.13)	0.26	< 0.001
Employed (vs. Non-employed)	0.84 (0.07–1.62)	0.08	0.034
<u>Tension Reduction Expectancy Domain Score</u>			
Higher levels of alcohol SMM exposure	0.33 (0.09–0.58)	0.10	0.008
Employed (vs. Non-employed)	0.26 (0.01–0.52)	0.08	0.048
<u>Health Benefits Expectancy Domain Score</u>			
Higher levels of alcohol SMM exposure	−0.21 (−0.50–0.46)	−0.01	NS
Single (vs Married /co-habituating/ others)	−0.63 (−1.13–0.14)	−0.10	0.012
University educated (vs Upper secondary educated)	−0.99 (−1.44–0.55)	−0.17	< 0.001
Female (vs Male)	−0.55 (−1.00–0.11)	−0.09	0.015
Exposure to traditional marketing	−1.07 (−1.57–0.59)	−0.17	< 0.001

Variables that demonstrated a $p < 0.20$ in the unadjusted analysis were included as candidate variables for a backward elimination linear regression mode; NS=non statistically significant.

The Total CDEQ-Adult positive expectancies score showed statistically significant mediation effects on all drinking behaviours except for future intention to drink to intoxication (Indirect effect (IE): 0.08–0.19, $p < 0.05$). Similarly, mediation analysis performed separately with each of the CDEQ-Adult subscales showed that the Interpersonal benefits,

Increased confidence, and Tension reduction subscales mediated that effect of high past month alcohol SMM exposure levels on various drinking behaviours. The Interpersonal benefits subscale and the Tension reduction subscale both showed a mediation effect on past month drinking, weekly drinking, binge drinking, risky drinking, and future intention to drink but not future intention to drink to intoxication (IE ranges from 0.07 to 0.21, $p < 0.05$). By contrast, Increased confidence drinking expectancy only demonstrated mediation effects on binge drinking (IE: 0.15) and risky drinking (IE:0.23, $p < 0.05$).

4. Discussion

This study was the first to examine influence of alcohol SMM on young Chinese adults drinking behaviour in Hong Kong, a city inundated with alcohol advertisements with few alcohol marketing regulations (Yu et al., 2023; Yu et al., 2022b). Similar to findings from previous studies (Jernigan, 2011; Palfai and Wood, 2001; Moreno et al., 2015), our study demonstrated that higher levels of alcohol SMM exposure are associated with positive drinking expectancies and drinking behaviors. Higher alcohol SMM exposure was associated with various positive drinking expectancies, past drinking behaviors, and future drinking intentions. Mediation analyses further revealed that positive drinking expectancies mediated the association between SMM exposure and various drinking behaviors, even future intention to drink. Although the relationship between exposure to alcohol SMM and drinking behaviours was not shown to be mediated by CDEQ total score, mediation analyses performed with each of the CDEQ subscales showed that the Interpersonal benefits, Increased confidence, and Tension reduction subscales mediated the effect of past month alcohol SMM exposures on many drinking behaviours. We conclude that alcohol SMM exposure is associated with positive drinking expectancies, which may, in turn, influence drinking behaviors and future drinking intentions.

Our findings regarding mediation contradict with those from a study conducted in the United States (Fleming et al., 2004). These differences may be rooted to the cultural differences in drinking. The prevalence of underage drinking in Hong Kong remains low compared to many western countries (Fisher and Roget, 2019; Department of Health, HKSAR, 2013). Thus, it is possible that Hong Kong youths may be exposed to alcohol and alcohol advertisements much later in their life. The three subscales of drinking expectancies with significant mediations (Interpersonal Benefits, Increased Confidence, and Tension Reduction) are well-aligned with messages promoted in online alcohol advertisements in Hong Kong (friendship, socialization, and relaxation) (Whitehead, 1977; Room, 1984). These positive images can greatly affect the drinking attitudes and behaviours of adolescents and young adults, who are still in the developmental stage (Meisel et al., 2022). Our study findings provide an evidence-base for types of marketing messages that need to be counterbalanced by public health workers.

5. Discussion

This study was the first to examine influence of alcohol SMM on young Chinese adults drinking behaviour in Hong Kong, a city inundated with alcohol advertisements with few alcohol marketing regulations (Surveillance and Epidemiology Branch, Centre for Health Protection, 2011; Yu et al., 2023). Similar to findings from previous studies (Yu et al., 2022b; Jernigan, 2011; Palfai and Wood, 2001), our study demonstrated that higher levels of alcohol SMM exposure are associated with positive drinking expectancies and drinking behaviors. Higher alcohol SMM exposure was associated with various positive drinking expectancies, past drinking behaviors, and future drinking intentions. Mediation analyses further revealed that positive drinking expectancies mediated the association between SMM exposure and various drinking behaviors, even future intention to drink. Although the relationship between exposure to alcohol SMM and drinking behaviours was not shown to be mediated by CDEQ total score, mediation analyses

Table 4

Mediation analysis model results by outcome measures with total positive drinking expectancies domain and subscales as mediator.

	Higher alcohol SMM exposure on drinking expectancy ($x \rightarrow \text{mediator}$)	Drinking expectancy on drinking outcome ($\text{mediator} \rightarrow y$)	Higher alcohol SMM exposure on outcome ($x \rightarrow y$)	Indirect effect ($m \cdot x$ on y)	% Mediation (IE/total effect)
Drinking Outcome	Coeff (SE)	Coeff (SE)	Coeff (SE)	IE (SE) 95 % CI	%
Mediation by total positive expectancies score					
Past month drinking	2.47 (0.87) ‡	0.04 (0.01) §	0.92 (0.19) §	0.11 (0.05) (0.03–0.22)	10.8 %
Weekly drinking	2.47 (0.87) ‡	0.07 (0.02) §	0.78 (0.42) *	0.18 (0.09) (0.03–0.39)	18.9 %
Binge drinking	2.47 (0.87) ‡	0.06 (0.01) §	1.24 (0.25) §	0.14 (0.07) (0.03–0.30)	10.1 %
Risky drinking	2.47 (0.87) ‡	0.08 (0.02) §	1.21 (0.44) ‡	0.19 (0.10) (0.04–0.43)	13.5 %
Future intention to drink	2.47 (0.87) ‡	0.03 (0.01) ‡	1.90 (0.22) §	0.08 (0.04) (0.01–0.18)	4.1 %
Mediation by Interpersonal benefits					
Past month drinking	1.01 (0.43) ‡	0.13 (0.02) ‡	0.96 (0.20) ‡	0.14 (0.07) (0.02–0.38)	12.8 %
Weekly drinking	1.01 (0.43) ‡	0.2 (0.05) ‡	0.87 (0.42) ‡	0.21 (0.11) (0.03–0.46)	19.6 %
Binge drinking	1.01 (0.43) ‡	0.12 (0.03) ‡	1.29 (0.25) ‡	0.12 (0.06) (0.02–0.27)	8.5 %
Risky drinking	1.01 (0.43) ‡	0.1 (0.04) ‡	1.32 (0.44) ‡	0.1 (0.07) (0.01–0.29)	7.0 %
Future intent to drink	1.01 (0.43) ‡	0.09 (0.02) ‡	1.92 (0.22) ‡	0.09 (0.04) (0.01–0.19)	4.5 %
Mediation by Tension Reduction					
Past month drinking	0.33 (0.13) ‡	0.37 (0.07) §	0.91 (0.19) §	0.12 (0.06) (0.03–0.24)	11.6 %
Weekly drinking	0.33 (0.13) ‡	0.48 (0.15) ‡	0.78 (0.43) *	0.16 (0.08) (0.03–0.33)	17.1 %
Binge drinking	0.33 (0.13) ‡	0.33 (0.08) ‡	1.24 (0.25) §	0.11 (0.06) (0.02–0.24)	8.2 %
Risky drinking	0.33 (0.13) ‡	0.40 (0.14) ‡	1.24 (0.44) ‡	0.13 (0.07) (0.02–0.3)	9.5 %
Future intent to drink	0.33 (0.13) ‡	0.22 (0.07) ‡	1.90 (0.22) §	0.07 (0.04) (0.01–0.16)	3.6 %
Mediation by Increased confidence					
Binge drinking	1.72(0.37) §	0.09 (0.03) ‡	1.21 (0.25) §	0.15 (0.07) (0.04–0.32)	11.0 %
Risky drinking	1.72(0.37) §	0.13 (0.05) ‡	1.18 (0.44) ‡	0.23 (0.12) (0.04–0.51)	16.4 %

Note: Coeff=estimated regression coefficient, SE = Standard Error, CI= confidence interval, IE= indirect effect. *P < 0.10; ‡P < 0.05; †P < 0.01; §P < 0.001. NA=non-applicable.

% mediation= IE/Total effect. For IE, non-inclusion of zero values in the 95 % CI indicates a significant result.

performed with each of the CDEQ subscales showed that the Interpersonal benefits, Increased confidence, and Tension reduction subscales mediated the effect of past month alcohol SMM exposures on many drinking behaviours. We conclude that alcohol SMM exposure is associated with positive drinking expectancies, which may, in turn, influence drinking behaviors and future drinking intentions.

Our findings regarding mediation contradict with those from a study conducted in the United States (Fleming et al., 2004). These differences may be rooted to the cultural differences in drinking. The prevalence of underage drinking in Hong Kong remains low compared to many western countries (Moreno et al., 2015; Fisher and Roget, 2019). Thus, it is possible that Hong Kong youths may be exposed to alcohol and alcohol advertisements much later in their life. The three subscales of drinking expectancies with significant mediations (Interpersonal Benefits, Increased Confidence, and Tension Reduction) are well-aligned with messages promoted in online alcohol advertisements in Hong Kong (friendship, socialization, and relaxation) (Department of Health, HKSAR, 2013; Whitehead, 1977). These positive images can greatly affect the drinking attitudes and behaviours of adolescents and young adults, who are still in the developmental stage (Room, 1984). Our study findings provide an evidence-base for types of marketing messages that need to be counterbalanced by public health workers.

Limitations

The cross-sectional nature of this study limits the ability to establish causal relationships between alcohol-related SMM exposure, drinking expectancies, and drinking behaviors. Bidirectional relationships are also plausible: individuals who consume alcohol may actively engage with alcohol-related content on social media, thereby increasing their SMM exposure, while SMM exposure may, in turn, encourage alcohol consumption. As the study examines past-month SMM exposure and past-month drinking behavior, establishing clear temporal precedence is challenging. Mediation analyses assume a temporal order, but the study design limits the ability to quantify the magnitude or direction of these effects. To address this, the study purposely included variables measuring future intention to drink and future intention to drink to intoxication. However, the reliance on self-reported measures of SMM exposure and drinking behavior can introduce recall bias. If drinking respondents overestimate their alcohol consumption this may inflate the strength of the associations observed. Future studies should consider using objective measures, such as digital tracking or platform data, to reduce reliance on self-reported data and improve validity. Even though Hong Kong has near ubiquitous social media penetration in this age group, those who use it infrequently (and thereby rarely encounter

alcohol SMM) and those who use it frequently (but are not targeted by SMM algorithms) were categorized as “non-exposed” in this study. Since these subgroups may differ in alcohol-related behaviors and risk profiles, possible differences should be clarified by future studies.

While longitudinal studies may provide insights into temporal relationships, they cannot fully resolve causal ambiguity due to potential bidirectional effects and unmeasured confounders. Experimental designs, such as randomized controlled trials, are necessary to establish causality and should be prioritized in future research. Additionally, future studies should explore the bidirectional nature of the relationship between SMM exposure and drinking behaviors and incorporate objective measures of SMM exposure to enhance data reliability.

6. Conclusions

Our study highlights the association between alcohol SMM exposure and drinking behaviors among young adults, indicates that policy makers should not ignore the influence of alcohol SMM, particularly in emerging alcohol markets where drinking behaviors are still evolving. Even in a traditionally low alcohol consumption culture such as Hong Kong, the alcohol industry has been able to leverage the wide reach of social media to promote drinking in young adults. Our study shows that the carefully crafted marketing messages resonate with young adults and are successful in encouraging drinking behaviors. Since public health warnings about the harms of alcohol may not be sufficient to counteract the effects of alcohol SMM, other measures may need to be considered by policymakers and health educators. In addition to prohibitions against showing inebriation and risky drinking behaviors in alcohol advertising, alcohol SMM regulation should carefully consider the underlying marketing messages of advertisements directed at young adults. Moreover, health education for adolescents and young adults will likely require inclusion of social media awareness-raising components. Due to the rapidly evolving nature of social media, future studies may examine alcohol SMM on other popular internet platforms.

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CRediT authorship contribution statement

Rufina H.W. Chan: Writing – original draft, Visualization, Validation, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Benjamin H.K. Yip:** Writing – review & editing, Supervision. **Man Ping Wang:** Writing – review & editing, Supervision. **Marc K.C. Chong:** Writing – review & editing, Supervision. **Dong Dong:** Writing – review & editing, Supervision. **Jean H. Kim:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Wit Wichaidit:** Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors have nothing to declare.

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