Research

What do we know about alcohol mixed with energy drink (AmED) use in Australia? Expanding local evidence

Amy Pennay[a,b,i], Amy Peacock[c,d], Nicolas Droste[b], Peter Miller[b], Raimondo Bruno[d], Phillip Wadds[e], Stephen Tomsen[f], Daniel Lubman[g,h]

[a] Centre for Alcohol Policy Research, La Trobe University, Melbourne, Victoria, Australia
[b] School of Psychology, Deakin University, Geelong, Victoria, Australia
[c] National Drug and Alcohol Research Centre, UNSW Sydney, Australia
[d] School of Medicine, University of Tasmania, Hobart, Australia
[e] School of Social Sciences, UNSW Sydney, Australia
[f] School of Social Sciences and Psychology, Western Sydney University, NSW, Australia
[g] Turning Point, Eastern Health, Melbourne, Victoria, Australia
[h] Eastern Health Clinical School, Monash University, Melbourne, Victoria, Australia
[i] Corresponding author: a.pennay@latrobe.edu.au

Article history

Key points

- This paper replicates two previously used survey approaches to consolidate a national picture of alcohol mixed with energy drink (AmED) consumption in Australia
- Approximately 40% of young current drinkers reported AmED consumption in the past 12 months, and 15% of people in entertainment districts reported AmED use in the past 12 hours
- Consistent with international research, AmED consumers are more likely to be younger, male and report riskier substance use
- Health promotion activities are warranted to promote awareness of energy drink guidelines and the potential harms of exceeding these guidelines among alcohol consumers

Abstract

Objectives: Despite continued health concerns associated with the practice of consuming alcohol mixed with energy drinks (AmED), few Australian studies have examined the popularity of this combination or attempted to characterise AmED consumers. The purpose of this paper is to replicate two previously used survey approaches to consolidate a national picture of AmED consumption in Australia.

Methods: The survey approaches used were: an online survey with a convenience sample of New South Wales (NSW), Australia, residents (n = 1931; 63.7% female; median age 23.0 years); and street intercept surveys in regional and metropolitan entertainment precincts in NSW (n = 1265; 58.2% male; median age 21.0 years). Analyses explored the rates and frequency of AmED use across both samples, and the sociodemographic and substance use predictors of AmED consumption in the past 12 months.

Results: More than 90% of participants in both samples reported alcohol consumption in the past 12 months, with approximately 40% of current drinkers also reporting AmED use in the past 12 months. Three-quarters of participants interviewed in entertainment precincts reported alcohol consumption in the previous 12 hours, with one in six of these also reporting AmED consumption in the past 12 hours. AmED users across both samples were more likely than alcohol-only consumers to be younger and male, and to report riskier substance use practices.

Conclusions: Health promotion activities are warranted to promote awareness of energy drink guidelines, and the potential harms of exceeding these guidelines, among alcohol consumers. In addition, health workers should consider enquiring about AmED use as an indicator of risk related to substance use.

Introduction

It has now been 20 years since alcohol mixed with energy drinks (AmED) were introduced in Australia.[1,2] In this time, standards have been implemented regarding the content and packaging of energy drinks (EDs)[3], and licensing restrictions on their sale have been introduced in some states.[4] These policy changes have been prompted by concerns about an increase in alcohol-related harms associated with AmED use.[5] Although comprising only a small proportion of total burden on healthcare services, AmED-related presentations to Australian poison information call centres, ambulance services and emergency departments have increased over time.[6-8] Further, consumers report that AmED consumption is dose-dependently linked to an increased risk of physiological side-effects, including heart palpitations, insomnia, tremors and fidgeting.[9] This situation makes quantifying the number of people who consume AmED, and understanding how they consume AmED, important to inform the development of targeted interventions.

To date, only three studies have estimated the number of Australians using AmED. One representative population study (*n* = 2000) in 2013 reported that only 5% of Australian adults had consumed AmED in the past 3 months; a higher rate of use (20%) was observed among people aged 18–24.[10] The other two studies targeted the younger ED consumer demographic: 42% of a community sample (*n* = 403) aged 18–35 reported AmED use in the past 6 months in 2011[11], and 21% of adults interviewed in five Australian city entertainment precincts on weekend nights (*n* = 4227) reported AmED use in the past 12 hours in 2011–2012.[12] The lack of prevalence data and inconsistency in estimates across study designs points to the need to replicate these approaches to obtain further estimates of use.

Aligning with international research, these earlier Australian studies showed that AmED consumers are generally younger[10,12], male and more likely to live in metropolitan areas compared with those who consume alcohol without EDs.[10] Further, AmED consumers appear to be heavier alcohol consumers, regardless of whether they are consuming alcohol with or without EDs. However, there has been limited exploration of other sociodemographic (e.g. education, employment), mental health and substance use risk factors for AmED consumption in an Australian context. Addressing this gap is critical for understanding the broader risk profile of AmED consumers for targeted intervention efforts.

The purpose of this paper is to replicate two previously used approaches[11,12] (a targeted online community survey and street intercept surveys in entertainment precincts) to consolidate a national picture of AmED consumption in Australia.

Methods

Participants and procedure

Study 1: Online survey

Between December 2012 and February 2013, a convenience sample of 2953 people aged 16 years or older residing in the Australian state of New South Wales (NSW) completed a self-administered online survey. Participants were invited regardless of previous AmED use and were recruited through Facebook, social events websites, internet forums, press releases, and professional and university network email communications. Survey completion time was 15–35 minutes.

Participants read a plain-language ethics statement before the survey began. The only exclusion criteria were being <16 years of age or living outside of NSW. Participant Internet Protocol addresses were collected to ensure unique responses. All participants entered a draw to win one of 10 Apple iPads.

Data cleaning removed responses with missing data for alcohol or AmED use (*n* = 753, which generally reflected people starting but not completing the survey); responses from people residing outside NSW (*n* = 228), or aged <16 (*n* = 26); and numerical outliers (*n* = 15). The final sample was 1931. More than half of the sample was female (*n* = 1231, 63.7%), with a median age of 23.0 years (range 16–70). Survey participants were recruited from 295 (out of a total 961) postcodes in NSW.

Study 2: Street intercept survey

Brief interviews were undertaken with 1307 people aged 16 years or older between December 2012 and February 2013 in NSW nightlife precincts. Interviews were undertaken in one major metropolitan city (Sydney) over 10 weeks and on one night in two regional cities (Newcastle and Orange). Researchers dressed in university-branded t-shirts worked in 4-hour shifts on Fridays and Saturdays, between 6 pm and 2 am. In Sydney (population about 5 million), four major nightlife hubs in the inner city were canvassed on rotation: Circular Quay (a popular tourist destination and entertainment

district), George Street (a central transport hub with late-trading venues), Darling Harbour (an entertainment and dining precinct with diverse patronage) and Kings Cross (the highest density late-trading district in Sydney). In Newcastle (population about 300 000) and Orange (population about 40 000), researchers conducted interviews in the main entertainment precinct. These locations were selected because they represented a small and a large regional town, both with university populations and busy entertainment districts.

Trained research staff approached potential interviewees as they walked past (i.e. when one interview was completed, the next person was approached). Interviewers explained the study aims and the nature of involvement. Participants received a business card with project contacts and ethics details. The interview began after verbal consent, and data were collected on iPod Touch devices. Interviewers were trained to identify intoxication, and patrons who appeared excessively intoxicated or unable to provide informed consent were not interviewed.

Numerical outliers and responses with missing data for AmED variables were removed, yielding a final sample size of 1265. Participant ages ranged between 16 and 55 years (median 21.0 years) and more than half ($n = 736$, 58.2%) were male. Four-fifths of interviews were undertaken in Sydney ($n = 1020$, 80.6%), with approximately one-tenth undertaken in Newcastle ($n = 125$, 10.0%) and Orange ($n = 120$, 9.5%). Ethics approval was granted from Deakin (2011-095) and Western Sydney (H9202) universities.

Measures

The demographic, and alcohol- and AmED-related questions used in this study replicate two previous AmED studies.[11,12] Age, gender and postcode were collected in both surveys. The online survey also collected information about marital status, education, employment and student status, mental health diagnoses (ever), and use of illicit drugs (past 12 months). Time of interview was recorded in the street survey.

Postcodes were used to generate Socio-Economic Indexes for Areas (SEIFA) scores, reflecting the level of socio-economic disadvantage in an area. SEIFA rankings are generated on a 10-point scale, with one being the most disadvantaged and 10 being the most advantaged.[13]

AmED use was defined as the consumption of alcohol and EDs either in the same container (hand-mixed or premixed), or separately within the same session. Alcohol and AmED consumption data were reported as standard drinks: equivalent to 10 g of ethanol and 80 mg of caffeine (a standard 250 mL ED container). In both surveys, participants were asked whether they had consumed alcohol or AmED in the past 12 months. If yes, data were collected on typical frequency (never, monthly or less, 2–4 times per month, 2–3 times per week,

4 or more times per week) and typical quantity of alcohol and ED intake in a session. In the street survey, participants were also asked about alcohol and AmED consumption in the past 12 hours.

The AUDIT-C[14], a three-item measure assessing alcohol use, frequency and intake on a 5-point Likert scale, was used in both surveys. A score of ≥4 for men and ≥3 for women is the cut-off for hazardous drinking.

Analysis

For analysis purposes, we collapsed SEIFA scores into a three-item measure: low (scores 1–4), medium (scores 5–6) and high (scores 7–10). Heavy alcohol consumption (>4 standard drinks in a single occasion of drinking) was dichotomised according to the Australian National Health and Medical Research Council guidelines for minimising the risk from a single occasion of drinking alcohol.[15] A binary variable for illicit stimulant use in the preceding 12 months (online survey) included self-reported consumption of ecstasy, cocaine, methamphetamine and/or mephedrone. Time of street interview was dichotomised into before 11 pm and 11 pm or later. The frequency options of '2–3 times per week' and '4 or more times per week' were combined for brevity into 'weekly or more'. A 'current session' of AmED use was defined as the past 12 hours, consistent with previous research.[16]

Data were analysed in Stata Statistical Software (College Station, TX: StataCorp LP; Release 14). Characteristics of AmED and alcohol-only consumers comprised percentages for categorical outcomes and medians for continuous outcomes. Bivariate logistic regression analyses were used to identify the predictors of reporting AmED consumption in the past 12 months relative to alcohol-only consumption (for both the online and street surveys), followed by multivariate logistic regression analyses that only included variables significant in bivariate analyses at the $p < 0.05$ level. Because of multicollinearity on alcohol items, only one measure of typical and current alcohol use was included in multivariate models.

Results

AmED use

Of the 1931 online survey participants, 1767 (91.5%) reported alcohol consumption in the past 12 months, with 41.4% ($n = 731$) of alcohol consumers also reporting AmED consumption in the past 12 months. Of the 1265 street survey participants, 1207 (95.4%) reported alcohol consumption in the past 12 months, with 39.3% ($n = 474$) of alcohol consumers also reporting AmED consumption in the past 12 months. Of the 954 (75.4%) street survey participants who reported alcohol use in the current session, almost one in six (14.4%, $n = 128$) also reported AmED use in the current session.

AmED consumption patterns

The majority of online survey participants reported consuming AmED monthly or less (80.9%), with the remainder consuming them weekly to monthly (16.4%), or more frequently than weekly (2.6%). A higher frequency of use was evident among street survey participants: 53.4% reported consuming AmED monthly or less, 36.3% reported weekly to monthly use, and 10.3% reported weekly or more frequent use.

For typical AmED drinking sessions in the past 12 months, online survey participants reported mean consumption of 6.0 (standard deviation [SD] 4.2) alcoholic drinks and 3.0 (SD 2.5) EDs per session, and street survey participants reported mean consumption of 8.4 (SD 5.9) alcoholic drinks and 3.5 (SD 2.8) EDs per session. Street survey participants reported consuming 9.1 (SD 6.4) alcoholic drinks and 2.9 (SD 2.2) EDs on average in the current session so far.

AmED consumer characteristics

In the online survey, bivariate analyses showed that, compared to alcohol-only consumers, AmED consumers had greater odds of being male, being younger, living in a regional area, currently studying but not having a higher education or university degree, consuming greater amounts of alcohol in alcohol sessions, exceeding the Australian guidelines for high-risk drinking in typical alcohol sessions, exceeding the AUDIT-C cut-off indicative of hazardous drinking, regular tobacco use, and using cannabis and illicit stimulants in the past 12 months; but lower odds of reporting a mental health diagnosis. In multivariate analyses, the variables that remained significant included younger age, exceeding the Australian guidelines for high-risk drinking in typical alcohol sessions, and consuming tobacco, cannabis and stimulants (Table 1).

In the street survey, bivariate analyses showed that AmED consumers were more likely to be male, younger and interviewed later in the evening, and were more likely to report greater alcohol intake in alcohol sessions, exceed the Australian guidelines for high-risk drinking in typical alcohol sessions, and exceed the AUDIT-C cut-off indicative of hazardous drinking. In multivariate analyses, male gender, age, exceeding the Australian guidelines for high-risk drinking in typical alcohol sessions and being interviewed later remained significant predictors of AmED use (Table 2).

Table 1. Characteristics of online survey participants and bivariate and multivariate logistic regression predictors of AmED relative to alcohol-only consumption in the past 12 months (*n* = 1767)

Characteristic	AmED consumer past 12 months (*n* = 731)	Alcohol-only consumer past 12 months (*n* = 1036)	Bivariate analysis			Multivariate analysis		
			OR	95% CI	*p* value (overall *p* value)[a]	OR	95% CI	*p* value (overall *p* value)[a]
Male	302 (41.3%)	336 (32.4%)	1.46	1.20, 1.78	<0.001	1.12	0.89, 1.41	0.331
Age, years (median, IQR)	22 (20–25)	25 (21–34)	0.92	0.91, 0.93	<0.001	0.93	0.91, 0.95	<0.001
Marital status (single)	306 (41.9%)	363 (35.0%)	0.97	0.79, 1.19	0.774	–	–	–
Located in capital city	109 (14.9%)	234 (22.6%)	0.60	0.47, 0.77	<0.001	1.01	0.73, 1.38	0.957
SEIFA[b] – low SES (reference category)	248 (37.9%)	372 (38.8%)	~	~	~	–	–	–
SEIFA[b] – medium SES	189 (28.9%)	261 (27.2%)	1.08	0.85, 1.39	0.511 (0.771)	–	–	–

Table 1. *continued*

Characteristic	AmED consumer past 12 months (*n* = 731)	Alcohol-only consumer past 12 months (*n* = 1036)	Bivariate analysis			Multivariate analysis		
			OR	95% CI	*p* value (overall *p* value)[a]	OR	95% CI	*p* value (overall *p* value)[a]
SEIFA[b] – high SES	218 (33.3%)	326 (34.0%)	1.00	0.79, 1.27	0.980 (0.771)	–	–	–
Education[c] – secondary school (reference category)	403 (55.6%)	412 (40.0%)	~	~	~	~	~	~
Education[c] – diploma or certificate	88 (12.1%)	144 (13.9%)	0.62	0.46, 0.84	0.002 (<0.001)	1.17	0.82, 1.68	0.386 (0.670)
Education[c] – university	234 (32.3%)	477 (46.2%)	0.50	0.41, 0.62	<0.001 (<0.001)	1.08	0.82, 1.43	0.591 (0.670)
Employed (full-time/part-time/casual)	581 (79.5%)	800 (77.2%)	1.14	0.91, 1.44	0.258	–	–	–
Currently studying	489 (66.9%)	576 (55.6%)	1.61	1.33, 1.96	<0.001	1.09	0.85, 1.41	0.486
Mental health diagnosis (ever)	154 (21.1%)	268 (25.9%)	0.76	0.61, 0.96	0.020	0.87	0.67, 1.13	0.301
Typical alcohol use (past 12 months) – number of drinks per session (median, IQR)	6.0 (4–9)	3.0 (2–5)	1.31	1.27, 1.36	<0.001	–	–	–
Typical alcohol use (past 12 months) – average quantity per session >4 standard drinks	504 (68.9%)	297 (28.7%)	5.52	4.49, 6.79	<0.001	3.70	2.96, 4.62	<0.001
AUDIT-C (exceed cut-off for hazardous drinking)	695 (95.1%)	757 (73.1%)	7.40	5.10, 10.72	<0.001	–	–	–
Tobacco use (monthly or more, past 12 months)	128 (17.5%)	99 (9.6%)	2.01	1.51, 2.66	<0.001	1.49	1.04, 2.14	0.029
Cannabis use (past 12 months)	210 (28.7%)	116 (11.2%)	3.20	2.49, 4.12	<0.001	2.33	1.57, 3.44	<0.001
Illicit stimulant use (past 12 months)	150 (20.5%)	56 (5.4%)	4.52	3.27, 6.24	<0.001	1.72	1.26, 2.34	0.001

– = not assessed; ~ = reference category; AmED = alcohol mixed with energy drink; CI = confidence interval; IQR = interquartile range; OR = odds ratio; SEIFA = Socio-Economic Indexes for Areas; SES = socio-economic status.

[a] The overall *p* value is presented for variables that have >2 categories

[b] Postcode and/or SEIFA missing for *n* = 153 (including from 76 AmED consumers and 77 alcohol-only consumers)

[c] Education missing for *n* = 9 (including from 6 AmED consumers and 3 alcohol-only consumers).

Table 2. Characteristics of street survey participants and bivariate and multivariate logistic regression predictors of AmED relative to alcohol-only consumption in the past 12 months (*n* = 1207)

Characteristic	AmED consumer past 12 months (*n* = 474)	Alcohol-only consumer past 12 months (*n* = 733)	Bivariate			Multivariate		
			OR	95% CI	*p* value (overall *p* value)[a]	OR	95% CI	*p* value
Male	310 (65.4%)	390 (53.2%)	1.66	1.31, 2.11	<0.001	1.64	1.28, 2.11	<0.001
Age (median, IQR)	20 (19–23)	22 (19–26)	0.93	0.91, 0.95	<0.001	0.93	0.91, 0.96	<0.001
Located in capital city	387 (81.7%)	581 (79.3%)	1.16	0.87, 1.56	0.311	–	–	–
SEIFA[b] – low SES (reference category)	156 (33.8%)	223 (31.4%)	~	~	~	–	–	–
SEIFA[b] – medium SES	97 (21.0%)	166 (23.3%)	0.84	0.60, 1.15	0.275 (0.551)	–	–	–
SEIFA[b] – high SES	208 (45.1%)	322 (45.3%)	0.92	0.71, 1.21	0.561 (0.551)	–	–	–
Typical alcohol use (past 12 months) – number of drinks per session (median, IQR)	9.0 (6–12)	6.0 (4–10)	1.07	1.05, 1.09	<0.001	–	–	–
Typical alcohol use (past 12 months) – average quantity per session >4 standard drinks	399 (84.2%)	489 (66.7%)	2.65	1.99, 3.55	<0.001	1.95	1.42, 2.68	<0.001
AUDIT-C (exceed cut-off for hazardous drinking)	453 (95.6%)	630 (85.9%)	3.53	2.17, 5.73	<0.001	–	–	–
Current alcohol use (tonight) – number of drinks in current session (median, IQR)	5.0 (1–8)	4.0 (0–7)	1.03	1.01, 1.05	<0.007	–	–	–
Current alcohol use (tonight) – >4 standard drinks in current session	274 (57.8%)	369 (50.3%)	1.45	1.15, 1.84	<0.002	1.05	0.81, 1.37	0.700
Time of night (11 pm or later)	260 (54.9%)	328 (44.7%)	1.50	1.19, 1.89	0.001	1.31	1.02, 1.69	0.035

– = not assessed; ~ = reference category; AmED = alcohol mixed with energy drink; CI = confidence interval; IQR = interquartile range; OR = odds ratio; SEIFA = Socio-Economic Indexes for Areas; SES = socio-economic status.
[a] The overall *p* value is presented for variables that have >2 categories
[b] Postcode and/or SEIFA missing for *n* = 35 (including from 13 AmED consumers and 22 alcohol-only consumers).

Discussion

This study consolidates a national picture of AmED consumption in Australia. Despite the different survey approaches, a similar proportion of current drinkers from NSW (approximately 40% in both samples) reported AmED consumption in the past 12 months. This is consistent with the findings of Peacock et al. (42%)[11], whose targeted community sample was predominantly from Tasmania, Australia. One in six (14.4%) drinkers interviewed in entertainment precincts reported AmED use on the current night, a little less than in previous street intercept research using the same design in five Australian cities (21%).[12] These figures are also broadly similar to international survey studies which show that 23–48% of young consumers report recent AmED use[17] and 13% of US bar patrons had consumed AmED in the previous 12 hours.[16]

Our findings also support previous Australian research that suggested AmED are generally consumed infrequently[10,11], although in this study, consumers interviewed in entertainment precincts reported greater frequency of consumption than online survey participants. Street survey participants also reported greater quantities of AmED use than online survey participants, suggesting that this population is a higher-risk group, and nightlife precincts might be appropriate locations for targeting AmED-related harm reduction efforts. Most participants, regardless of the sampling approach, reported exceeding the recommended daily intake of EDs (>2 standard 250 mL EDs) specified by Food Standards Australia New Zealand[3], and ED intake in AmED sessions was higher in this study (an average of 3.0 EDs among online survey participants and 3.5 EDs among street survey participants) compared with previous Australian research[10-12] (previous maximum recorded was 2.4 EDs).[11]

There were some divergent findings between our study and previous research, with AmED users in the online sample being more likely to report regional residency and less likely to report previous mental health diagnosis than alcohol-only consumers.[10] We also did not find a significant association between AmED use and being single, unlike previous research.[18] However, the remaining sociodemographic and alcohol use differences between AmED and alcohol-only consumers were largely consistent between the online and street surveys and confirm what is reflected in international research – AmED consumers are younger, more likely to be male, more likely to have only secondary school education but also be currently studying, consume more alcohol in general, and report greater use of tobacco and other drugs.[10,17-22]

Although AmED users generally consume more alcohol than alcohol-only consumers, the role AmED plays in driving risky consumption remains unclear.[17,23] It may be that AmED consumers are attracted to EDs because they are prone to riskier consumption practices and risk-taking behaviour. For example, as we have shown, they are also more likely to consume tobacco and other drugs.

It may therefore be useful to position AmED use as one of many indicators of risky substance use and subsequent harms, akin to heavy episodic drinking, tobacco use or use of illicit substances. Health professionals might find it useful to enquire about AmED consumption among young people to identify potential problematic alcohol and substance use.

Given that AmED-related presentations to emergency services have increased over time[6-8], and consumers report adverse effects from AmED consumption[9], the lack of public health effort directed towards reducing AmED use in Australia is surprising. Although major legislative changes in the supply and sale of AmED are unlikely, a range of relatively inexpensive health promotion efforts could be considered to reduce AmED-related harms. For example, targeted media or education programs raising awareness about the harms of excessive AmED use could be incorporated into existing alcohol campaigns or school-based alcohol education initiatives that have been shown to be effective.[24,25]

In addition, we found more frequent and heavy AmED use among street survey participants, suggesting licensed venues might be an ideal location for health promotion work. Little effort has been put into ensuring that Australian ED guidelines, which recommend consuming no more than two standard EDs per day[3], are understood and adhered to by consumers. Indeed, it has been shown that these guidelines are widely unknown[26] and, aside from restrictions on the sale of AmED after midnight in Western Australia[4], licensees in most states are not obliged to ensure that patrons are not consuming excessive quantities of AmED. Although policing AmED consumption might be difficult, large servings of EDs in excess of the intake guidelines – such as pints or jugs – should be prohibited. In addition, targeted information about Australian ED guidelines and the potential harms of consumption in excess of these guidelines could be placed in easy view of patrons, such as in the bathrooms of licensed venues.

It is important to consider that both the online and street surveys involved targeted convenience samples of young alcohol consumers and the findings cannot be generalised to all young AmED consumers. There are also potential recall issues associated with retrospective self-report, particularly in the context of the street survey where most participants had consumed alcohol before being interviewed. The street intercept survey was undertaken during the summer months in Australia, when drinking levels and patterns may differ from winter months. Because of time constraints, we were not able to ask a full range of demographic questions, and extra items such as ethnicity, occupation and sexual orientation may elicit useful findings. It is also important to note that SEIFA scores are inferred from postcode and therefore may not accurately reflect an individual's socio-economic status.

Conclusions

AmED are popular among young current drinkers in Australia, with approximately 40% reporting recent use in three separate convenience samples (our online and street intercept surveys, as well as a previous Tasmanian study[11]), and approximately 15–20% of people in entertainment precincts reporting use in the previous 12 hours.[12] AmED consumers are more likely than alcohol-only consumers to be young males who consume more alcohol and other substances, and, as such, targeted interventions towards these higher-risk consumers are warranted – such as ensuring that consumers are knowledgeable about the maximum recommended daily intake of EDs and the harms associated with consumption exceeding these guidelines.[3] Clinicians and public health professionals should also consider AmED consumption as an indicator of risk related to substance use, analogous to heavy episodic drinking, tobacco use or use of illicit substances.

Acknowledgements

Peer review and provenance

Externally peer reviewed; not commissioned.

Competing interests

PM received grants from the Australian Research Council, the Foundation for Alcohol Research and Education, the National Drug Law Enforcement Research Fund, VicHealth and Cancer Council Victoria during the conduct of the study. Personal fees were received from Greenland Legal Pty Ltd, outside the submitted work. This related to PM being an expert witness for a licensed venue and security service legal case.

Author contributions

All authors were involved in the project design. DL, PM, RB and ST provided project supervision. ND and PW were responsible for data collection and reporting. APennay, ND and APeacock were involved in analysis. APennay drafted the manuscript, and all authors contributed to redrafting.

References

1. Jones SC, Barrie L, Berry N. Why (not) alcohol energy drinks? A qualitative study with Australian university students. Drug Alcohol Rev. 2012;31(3):281–7.

2. Reissig CJ, Strain EC, Griffiths RR. Caffeinated energy drinks – a growing problem. Drug and Alcohol Depend. 2009;99:1–10.

3. Food Standards Australia New Zealand. Australia New Zealand Food Standards Code. Standard 2.6.4: Formulated caffeinated beverages. Canberra: Department of Health and Ageing; 2016 [cited 2018 June 7]. Available from: www.legislation.gov.au/Details/F2015L00467

4. Cox N. Drink bans introduced to tackle alcohol-fuelled violence. Perth Now. 2011 April 9 [cited 2018 Mar 28]. Available from: www.perthnow.com.au/news/western-australia/drink-bans-introduced-to-tackle-alcohol-fuelled-violence/news-story/d518f60a32d23d10d824d39abd0df1db

5. Pennay A, Lubman D, Miller P. Combining energy drinks and alcohol – a recipe for trouble? Aust Fam Physician. 2011;40(3):104–7.

6. Gunja N, Brown JA. Energy drinks: health risks and toxicity. Med J Aust. 2012;196(1):46–9.

7. Lubman D, Peacock A, Droste N, Pennay A, Miller P, Bruno R, et al. Alcohol and energy drinks in NSW. Sydney: NSW Health; 2013 [cited 2018 Mar 28]. Available from: www.health.nsw.gov.au/aod/resources/Publications/alcohol-and-energy-drinks-in-nsw.pdf

8. Turning Point. Victorian ambulance data: AOD stats; 2016 [cited 2016 Jan 12]. Available from: aodstats.org.au

9. Droste N, Peacock A, Bruno R, Pennay A, Zinkiewicz L, Lubman D, Miller P. Combined use of alcohol and energy drinks: dose relationship with self-reported physiological stimulation and sedation side effects. Addict Behav. 2017;71:68–74.

10. Pennay A, Cheetham A, Droste N, Miller P, Lloyd B, Pennay D, et al. An examination of the prevalence, consumer profiles, and patterns of energy drink use, with and without alcohol, in Australia. Alcohol Clin Exp Res. 2015;39(8):1485–92.

11. Peacock A, Bruno R, Martin FH. Patterns of use and motivations for consuming alcohol mixed with energy drinks. Psychol Addict Behav. 2013;27(1):202–6.

12. Pennay A, Miller P, Busija L, Jenkinson R, Droste N, Quinn B, et al. 'Wide-awake drunkenness'? Investigating the association between alcohol intoxication and stimulant use in the night-time economy. Addiction. 2015;110(2):356–65.

13. Australian Bureau of Statistics. Socio-Economic Indexes for Areas (SEIFA). Canberra: Australian Bureau of Statistics; 2011 [cited 2018 Mar 28]. Available from: www.abs.gov.au/websitedbs/censushome.nsf/home/seifa

14. Babor TF, Higgins-Biddle JC, Saunders JB, Monteiro MG. The Alcohol Use Disorders Identification Test: guidelines for use in primary care. Geneva: World Health Organization; 2001 [cited 2018 Jun 7]. Available from: apps.who.int/iris/bitstream/handle/10665/67205/WHO_MSD_MSB_01.6a.pdf;jsessionid=A70906FBCC56C8C9EC4F1D0FB55FD9F2?sequence=1

15. National Health and Medical Research Council. Australian guidelines to reduce health risks from drinking alcohol. Canberra: NHMRC; 2009 [cited 2018 Mar 28]. Available from: www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ds10-alcohol.pdf

16. Thombs DL, O'Mara RJ, Tsukamoto M, Rossheim ME, Weiler RM, Merves ML, Goldberger BA. Event-level analyses of energy drink consumption and alcohol intoxication in bar patrons. Addict Behav. 2010;35(4):325–30.

17. Peacock A, Pennay A, Droste N, Bruno R, Lubman D. 'High' risk? A systematic review of the acute outcomes of mixing alcohol with energy drinks. Addiction. 2014;109(10):1612–33.

18. Berger LK, Fendrich M, Chen HY, Arria AM, Cisler RA. Sociodemographic correlates of energy drink consumption with and without alcohol: results of a community survey. Addict Behav. 2011;36(5):516–9.

19. O'Brien MC, McCoy TP, Rhodes SD, Wagoner A, Wolfson M. Caffeinated cocktails: energy drink consumption, high-risk driving, and alcohol related consequences among college students. Acad Emerg Med. 2008;15(5):453–60.

20. Snipes DJ, Benotsch EG. High-risk cocktails and high-risk sex: examining the relation between alcohol mixed with energy drink consumption, sexual behavior, and drug use in college students. Addict Behav. 2013;38(1):1418–23.

21. Velazquez CE, Poulos NS, Latimer LA, Pasch KE. Associations between energy drink consumption and alcohol use behaviors among college students. Drug Alcohol Depend. 2012;123(1–3):167–72.

22. Peacock A, Bruno R, Ferris J, Winstock A. Energy drink use frequency among an international sample of people who use drugs: associations with other substance use and well-being. Drug Alcohol Depend. 2017;174:70–9.

23. McKetin R, Coen A, Kaye S. A comprehensive review of the effects of mixing caffeinated energy drinks with alcohol. Drug Alcohol Depend. 2015;151:15–30.

24. Foxcroft DR, Tsertsvadze A. Universal school-based prevention programs for alcohol misuse in young people. Cochrane Database Syst Rev. 2011;11(5):CD009113.

25. Wakefield M, Loken B, Hornik R. Use of mass media campaigns to change health behaviour. Lancet. 2010;376(9748):1261–71.

26. Peacock A, Droste N, Pennay A, Miller P, Lubman D, Bruno R. Awareness of energy drink intake guidelines and associated consumption practices: a cross-sectional study. BMC Public Health. 2016;16(6):1–11.