An Examination of the Prevalence, Consumer Profiles, and Patterns of Energy Drink Use, With and Without Alcohol, in Australia

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Background: There has been a significant growth in the energy drink (ED) market in Australia and around the world; however, most research investigating the popularity of ED and alcohol and energy drink (AED) use has focused on specific subpopulations such as university students. The aim of this study was to estimate the prevalence, consumption patterns, and sociodemographic correlates of ED and combined AED use among a representative Australian population sample.

Methods: A computer-assisted telephone interview survey (n = 2,000) was undertaken in March–April 2013 of persons aged 18 years and over. Half of the interviews were obtained through randomly generated landline telephone numbers and half through mobile phones. Approximately half of the sample was female (55.5%; n = 1,110) and the mean age of participants was 45.9 (range 18 to 95, SD 20.0).

Results: Less than 1 in 6 Australians reported ED use (13.4%, n = 268) and 4.6% (n = 91) reported AED use in the past 3 months. Majority of ED and AED users consumed these beverages monthly or less. ED and AED users are more likely to be aged 18 to 24 years, live in a metropolitan area, and be moderate risk or problem gamblers. AED consumers are more likely to report moderate levels of psychological distress.

Conclusions: Our findings in relation to problem gambling and psychological distress are novel and require further targeted investigation. Health promotion strategies directed toward reducing ED and AED use should focus on young people living in metropolitan areas and potentially be disseminated through locations where gambling takes place.

Key Words: Alcohol, Energy Drinks, Alcohol and Energy Drinks, Australia.

ENERGY DRINKS (EDs), which are caffeinated beverages that are marketed as providing mental and physical stimulation, have become increasingly popular since the introduction of Red Bull® to Australia in the mid-1990s (Reissig et al., 2009). There has been a significant growth in the ED market in Australia and New Zealand, with sales more than quadrupling between 2001 and 2010 (from 34.5 million liters to 156.6 million liters sold). Along with the United States, Australia has the highest yearly consumption of EDs at approximately 4.2 l per person (Zest Health Strategies, 2012).

In the early 2000s, EDs became a popular mixer with alcohol, particularly with spirits such as vodka and Jagermeister, and in 2003, premixed alcohol and energy drinks (AEDs) hit the market (Jones et al., 2012). AED consumption has attracted a significant amount of attention in the past few years, with public health bodies suggesting that combining alcohol (a depressant) with EDs (a stimulant) may result in additional risks above those of either beverage alone (Berger et al., 2011).

Consumption of EDs above recommended levels can result in symptoms consistent with caffeine overdose or toxicity, including anxiety, insomnia, gastrointestinal upset, and tachycardia (Reissig et al., 2009). The same caffeine toxicity symptoms can be experienced when consuming AEDs above safe levels; however, additional concerns may exist when adding alcohol to EDs, such as caffeine potentially enabling greater alcohol intake, dehydration, and engagement in risk-taking behaviors (Brache and Stockwell, 2011; O'Brien et al., 2008; Pennay and Lubman, 2012). The increase over time in both ED- and AED-related presentations, as seen in Australian poison center data (Gunja and Brown, 2012), underscores the need for a greater understanding of the popularity

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of use, demographics of consumers, and patterns of ED and AED consumption, so that targeted interventions can be designed and disseminated.

While sales data indicate a substantial increase in ED sales, little else is known about the popularity and consumption patterns of EDs and AEDs in Australia, including who the primary consumers of the beverages are. Most research in this space has been conducted in the United States and has focused on specific subpopulations such as university students. The findings of this research suggest that 20 to 50% of U.S. students report past month ED consumption (Malinauskas et al., 2007; Velazquez et al., 2012; West et al., 2006) and that 15 to 29% report past month AED consumption (Brache and Stockwell, 2011; Miller, 2012; O'Brien et al., 2008; Velazquez et al., 2012). With the exception of O'Brien and colleagues (2008), which involved stratified random sampling across 10 universities ($n = 4{,}271$), these studies involved convenience sampling of a relatively small number of university students (between $n = 265$ and $n = 648$). Only 1 U.S. study, conducted by Berger and colleagues (2011), has examined ED and AED use in a population sample using random-digit dialing ($n = 946$). The findings of this study of Milwaukee residents revealed lower rates than those from student samples, with 26.3% reporting past year ED consumption and 6.3% reporting past year AED consumption. Compared to their non-ED using counterparts, past year ED users were more likely to be male, of a non-Black minority, young (18 to 29 years), single, living in a metropolitan area, high school or college educated, and employed. Past year AED consumers did not vary from past year ED users, with the exception of being younger and more likely to be unemployed and single. This study only involved phone calls to landlines, meaning individuals who only own mobile phones were not represented in the study.

No Australian research has explored the popularity of EDs and AEDs in population samples, but there have been 2 studies exploring use among subpopulations. In regard to ED use, Trapp and colleagues (2013), drawing on 20-year follow-up data from a Western Australian birth cohort study, found that nearly half (48%) of all participants ($n = 1{,}234$, 53% female, mean age 20 years) consumed EDs once a month, with an average intake of 1.31 EDs per occasion. The most significant demographic correlates of ED consumption among this sample were being male, employed, and a regular user of other substances including cigarettes, alcohol, and ecstasy. This study was geographically focused on Western Australia and the sample was limited to young adults. In terms of AED use, Peacock and colleagues (2012, 2013), reporting on a sample of purposefully recruited community members (through advertisements in licensed venues and social media), found that 42% of participants ($n = 403$, 61% female, mean age 23.1 years [range 18 to 35]) had used AEDs in the past 6 months. The majority reported AED consumption monthly or less and consumed approximately 2.4 EDs and 7.1 alcoholic drinks per occasion. This convenience sample involved participants predominantly from Tasmania and was restricted to young adults (aged 18 to 35 years).

Given the limited understanding of who is using EDs and AEDS in Australia, the aims of this study were to (i) estimate the prevalence of ED and AED use in a representative sample of the Australian population, (ii) examine the sociodemographic characteristics of ED and AED consumers, and (iii) describe patterns of AED use, for the first time in an Australian population sample.

MATERIALS AND METHODS

Participants

A computer-assisted telephone interview (CATI) survey ($n = 2{,}000$) was undertaken in March–April 2013. The population for the survey was persons aged 18 years and over contactable via a landline telephone connection and/or mobile phone. Just over half of the sample was female (55.5%; $n = 1{,}110$) and the mean age of participants was 45.9 (range 18 to 95, SD 20.0). The majority of participants were born in Australia (64.7%; $n = 1{,}293$), and participants from the United Kingdom (7.1%; $n = 142$), New Zealand (3.3%; $n = 65$), China (3.1%; $n = 61$), and India (2.5%; $n = 50$) were also represented. Twenty-four (1.2%) participants identified as being aboriginal and/or Torres Strait Islander. Participants from each state and territory in Australia were represented, with two-thirds of participants (68.9%; $n = 1{,}377$) living in capital cities and the remainder (31.1%; $n = 623$) living outside capital cities.

In terms of national representativeness, participants were slightly more likely to be female than the Australian population (55.5% versus 50.6%), were 8 years older (45.9 vs. 37 years), were slightly less likely to be born in Australia (64.7% vs. 69.8%), and were less likely to be aboriginal or Torres Strait Islander (1.2% vs. 2.5%). The proportion of participants living in capital cities matched that of the Australian population (68.9% vs. 69%) (Australian Bureau of Statistics, 2011). Survey weights were applied during analysis to align the sample with independent population benchmarks (detailed in the Analysis section).

Procedure

The survey used a dual-frame design whereby half of the interviews ($n = 1{,}000$) were obtained from randomly generated landline telephone numbers and half ($n = 1{,}000$) from randomly generated mobile phone numbers. An increasing proportion of the Australian population resides in "mobile phone only" households (currently estimated to be around 19% of adults; Australian Communications and Media Authority, 2011). Residents of such households are not contactable via traditional landline telephone interviewing, and so it was deemed important to use a dual-frame design. The survey was administered by trained interviewers from the Social Research Centre in Melbourne. The landline sample was purposefully geographically stratified across 15 Australian regions: the capital cities ($n = 7$) and surrounding areas ($n = 7$) of the 7 largest Australian states/territories, and the whole population for the smallest Australian state ($n = 1$, Australian Capital Territory). As such, the geographic distribution of the landline sample closely matches that of the Australian population (Australian Bureau of Statistics, 2011). The mobile phone sample was a simple random sample as there are no geographic identifiers for mobile phone numbers. However, the mobile phone sample also produced a geographic distribution similar to that of the Australian population aged 18 years and over (Australian Bureau of Statistics, 2011).

Mobile telephone participants who answered the phone and were in scope (i.e., met the inclusion criteria such as being older than

18 years of age) were invited to participate in the survey. Landline participants were randomly allocated to 1 of 2 selection techniques: (i) the "next" birthday method, and (ii) identifying the number of in-scope household members and where there were 2 in-scope members, randomly selecting 1; and where there were 3 or more in-scope members, alternating between the first and last birthday methods. The intention of using both approaches was to attempt to reduce the overrepresentation of women that is commonly associated with the first and last birthday method (Lavrakas et al., 2012). Strategies adopted to maximize response rate included repeated call backs, leaving messages on voicemail services, offering a toll-free return number, and interviewing in languages other than English (a total of 52 interviews were conducted in 6 other languages).

The response rate for the study was 19.5% and the cooperation rate (interviews/interviews + partial interviews + refusals) was 43.1% (these were calculated using the American Association of Public Opinion Research (AAPOR) standards, version 3; APPOR, 2011). As there is no widely adhered to standard regarding the calculation and reporting of response rates in Australia, it is difficult to find comparative norms. In 2012, the highly regarded U.S. survey organization, the Pew Research Center, reported typical response rates for its general population dual-frame CATI surveys of 9% and typical cooperation rates of 14% (Pew Research Center, 2012). On this basis, the response and cooperation rates achieved for this study compare favorably. The interview took an average of 14.25 minutes to complete. The study was approved by the University of Queensland Behavioural and Social Sciences Ethical Review Committee (2011001133).

Measures

Questions about EDs and AEDs were designed specifically for this study, including frequency of use in the past 3 months and quantity of use on a typical occasion. The following questions were asked: "In the past 3 months, how often did you consume energy drinks such as Red Bull, V, and Mother alone, without alcohol?" and "In the past 3 months, how often did you drink alcohol mixed with energy drinks? This includes mixing alcohol and energy drinks together in the same drink, as well as consuming them separately in the same session of alcohol use." Options included "never," "monthly or less," "2 to 4 times per month," "2 to 3 times a week," "4 or more times a week," and "daily." AED users were also asked: "Thinking about a typical occasion when you consumed energy drinks with alcohol in the past 3 months, about how many standard drinks of alcohol (i.e., 1 shot of spirits, 1 middy/pot of full strength beer, or 1 small glass of wine) would you have consumed over the course of the session?" The same was asked of ED quantity during AED sessions: "Still thinking about a typical occasion when you consumed alcohol with energy drinks, approximately how many standard energy drinks (i.e., 250 ml cans) would you have consumed over the course of the session?"

The interview also gathered information about demographics (gender, age, place of residence, education, income); general health (self-reported as excellent/very good, good/fair, or poor); psychological distress (the Kessler 6—6 questions about psychological distress scored according to frequency of experience [all/most/some/a little/none of the time], with scores of 6 to 11 being low, 12 to 19 being mild/moderate, and 20 to 30 being high levels of psychological distress; Kessler et al., 2003); alcohol (frequency of "binge" drinking, defined as 5+ standard drinks as per the Australian National Health and Medical Research Council guidelines; NHMRC, 2009); tobacco (frequency); and gambling (the Problem Gambling Severity Index—9 questions about gambling scored according to frequency [never/sometimes/most of the time/almost always] with scores of 0 to 2 being nonproblem/low problem gambling, 3 to 7 being moderate problem gambling, and 8 or more being problem gambling; Ferris and Wynne, 2001).

Analysis

Survey weights were applied to adjust for the chance of selection in the survey, and poststratification was undertaken to align the sample with independent population benchmarks for age, gender, education, country of birth, location, and telephone status. Descriptive statistics were initially computed to explore the demographics and drinking patterns of ED and AED consumers. A series of bivariate and multivariate logistic regression analyses (including all variables) were then undertaken to determine the significant predictors of ED and AED use. To enable this analysis, ED consumption and AED consumption were re-coded into dichotomous variables: (i) those who had consumed EDs *without alcohol only* (at any frequency, $n = 212$) versus those who had not consumed EDs or AEDs in the past 3 months ($n = 1{,}696$) and (ii) those who had consumed AEDs (at any frequency, $n = 91$) versus those who had not consumed EDs or AEDs in the past 3 months ($n = 1{,}696$). More than half of the AED sample (2.8%, $n = 56$) were dual users; that is, they reported both ED and AED consumption, and these participants were included only in the AED model.

Analyses were performed using version 21 of the Statistical Package for the Social Sciences (IBM Corp, 2012). In all analyses, p-values < 0.05 were interpreted as statistically significant.

RESULTS

Energy Drink Use

One participant declined to answer the questions regarding ED use. Of the remaining 1,999 participants, 13.4% ($n = 268$) had consumed EDs in the past 3 months (of which 56 had also consumed AEDs). Males (21.5%; $n = 191$) were more likely to report ED use in the past 3 months than females (6.9%; $n = 77$), and 18- to 24-year-olds (36.8%; $n = 86$) and 25- to 39-year-olds (24.3%; $n = 114$) were the age groups most likely to report ED use in the past 3 months. Participants recruited through mobile phones (20.1%, $n = 201$) were more likely to report ED use than participants recruited through landline telephones (6.7%; $n = 67$). Of all participants who reported consuming EDs, more than one-third (37.7%; $n = 101$) reported less than monthly use, 26.5% ($n = 71$) reported using 2 to 4 times a month, 16.8% ($n = 45$) reported using 2 to 3 times a week, 7.0% ($n = 19$) reported using 4 or more times a week, and 11.9% ($n = 32$) reported daily use.

Bivariate analyses revealed that the odds of being an ED user were increased by being male (odds ratio [OR] = 2.83, confidence interval [CI] = 2.04 to 3.94, $p < 0.001$), living in a metropolitan area, (OR = 1.66, CI = 1.15 to 2.39, $p < 0.001$), scoring moderate (compared to low) levels of psychological distress (OR = 1.44, CI = 1.02 to 2.05, $p = 0.04$), being a daily (OR = 2.33, CI = 1.56 to 3.48, $p < 0.001$) or occasional (OR = 3.75, CI = 2.12 to 6.63, $p < 0.001$) smoker, and being classified as a moderate risk/problem gambler (OR = 3.89, CI = 1.77 to 8.52, $p = 0.001$). ED users were also more likely to be aged 18 to 24 (OR = 14.70, CI = 8.81 to 23.67, $p < 0.001$), 25 to 39 (OR = 9.09, CI = 5.81 to 14.20, $p < 0.001$), and 40 to 49 (OR = 4.91, CI = 2.49 to 6.94, $p < 0.001$), compared to 50+,

and to report binge drinking 2 or more times a week (OR = 2.16, CI = 1.40 to 2.95, $p < 0.001$), 2 to 4 times a month (OR = 2.41, CI = 1.60 to 3.62, $p < 0.001$), and monthly or less (OR = 2.14, CI = 1.23 to 3.14, $p < 0.001$), compared to never.

Multivariate logistic regression analysis, detailed in Table 1, revealed the odds of being an ED user were increased by being male, younger, living in a metropolitan area, and smoking. Completing less than secondary level education showed trend-level associations ($p = 0.06$) for reducing the likelihood of ED use, and being classified as a moderate risk/problem gambler showed trend-level associations ($p = 0.05$) for increasing the likelihood of ED use. There were no significant differences between ED and non-ED users in regard to general health, psychological distress, income, or binge drinking.

Alcohol and Energy Drink Use

A smaller proportion of the sample (4.6%; $n = 91$) reported consuming AEDs in the past 3 months. As with ED use, males (6.9%; $n = 61$) were more likely to report AED use in the past 3 months than females (2.7%; $n = 30$), as were 18- to 24-year-olds (20.1%; $n = 47$) and 25- to 39-year-olds (7.5%; $n = 35$). During a typical AED session, participants reported consuming 4.7 alcoholic

Table 1. Energy Drink Users ($n = 212$) Compared to Nonusers ($n = 1,696$)[a]

	n	% ED users (CI[b])	% non-ED users (CI)	OR	CI	*p*
Gender						
Male	828	17.75 (15.21 to 20.53)	82.25 (79.47 to 84.79)	2.92	1.97 to 4.31	<0.001
Female	1,080	6.02 (4.68 to 7.61)	93.98 (92.39 to 95.32)	–	–	–
Age						
18 to 24	187	29.95 (23.48 to 37.06)	70.05 (62.94 to 76.52)	23.89	11.33 to 50.37	<0.001
25 to 39	434	21.20 (17.45 to 25.35)	78.80 (74.65 to 82.55)	12.45	6.62 to 23.43	<0.001
40 to 49	338	10.95 (7.83 to 14.77)	89.05 (85.23 to 92.17)	4.81	2.46 to 9.41	<0.001
50+	939	2.88 (1.90 to 4.16)	97.12 (95.84 to 98.10)	–	–	–
Place of residence						
Metro	1,302	12.75 (10.99 to 14.68)	87.25 (85.32 to 89.01)	1.63	1.06 to 2.50	0.03
Nonmetro	606	7.59 (5.61 to 10.00)	92.41 (90.00 to 94.39)	–	–	–
Education						
Less than secondary education	436	10.78 (8.03 to 14.08)	89.22 (85.92 to 91.97)	0.57	0.32 to 1.03	0.06
Completed secondary education	380	15.53 (12.03 to 19.57)	84.47 (80.43 to 87.97)	0.70	0.40 to 1.25	0.23
Some postsecondary education	423	9.22 (6.64 to 12.39)	90.78 (87.61 to 93.36)	0.85	0.48 to 1.50	0.58
Completed degree	615	10.24 (7.96 to 12.92)	89.76 (87.08 to 92.04)	–	–	–
Income (pretax)						
Refused	250	7.20 (4.32 to 11.14)	92.80 (88.86 to 95.68)	0.95	0.50 to 1.80	0.86
Do not know	176	12.50 (8.00 to 18.31)	87.50 (81.69 to 92.00)	0.65	0.34 to 1.23	0.19
<$20,000	189	14.81 (10.08 to 20.69)	85.19 (79.31 to 89.92)	1.60	0.76 to 3.39	0.22
$20,000 to $40,000	278	7.19 (4.45 to 10.89)	92.81 (89.11 to 95.55)	0.73	0.36 to 1.47	0.37
$40,000 to $80,000	457	12.25 (9.39 to 15.62)	87.75 (84.38 to 90.61)	0.91	0.56 to 1.50	0.72
$80,000+	558	12.19 (9.59 to 15.19)	87.81 (84.81 to 90.41)	–	–	–
General health						
Excellent/very good	1,067	11.06 (9.24 to 13.10)	88.94 (86.90 to 90.76)	0.50	0.15 to 1.60	0.24
Good/fair	760	11.32 (9.15 to 13.79)	88.68 (86.21 to 90.85)	0.49	0.15 to 1.55	0.22
Poor	76	9.21 (3.78 to 18.06)	90.79 (81.94 to 96.22)	–	–	–
Psychological distress						
High	69	15.94 (8.24 to 26.74)	84.06 (73.26 to 91.76)	0.80	0.30 to 2.16	0.66
Moderate	399	14.79 (11.45 to 18.66)	85.21 (81.34 to 88.55)	0.93	0.60 to 1.46	0.77
Low	1,438	9.87 (8.38 to 11.53)	90.13 (88.47 to 91.62)	–	–	–
Smoking						
Daily smoker	254	18.50 (13.92 to 23.84)	81.50 (76.16 to 86.08)	2.87	1.61 to 5.12	<0.001
Occasional smoker	79	29.11 (19.43 to 40.42)	70.89 (59.58 to 80.57)	3.95	1.86 to 8.40	<0.001
Past smoker	451	7.54 (5.28 to 10.38)	92.46 (89.62 to 94.72)	1.39	0.84 to 2.31	0.20
Never smoked regularly	1,123	9.62 (7.96 to 11.49)	90.38 (88.51 to 92.04)	–	–	–
Binge drinking (past 3 months)						
2 or more times a week	164	15.24 (10.11 to 21.68)	84.76 (78.32 to 89.89)	0.95	0.51 to 1.79	0.88
2 to 4 times a month	205	18.05 (13.04 to 24.01)	81.95 (75.99 to 86.96)	1.08	0.63 to 1.86	0.77
Monthly or less	294	15.65 (11.69 to 20.31)	84.35 (79.69 to 88.31)	1.12	0.69 to 1.78	0.67
Never	1,241	8.38 (6.90 to 10.06)	91.62 (89.94 to 93.10)	–	–	–
Gambling						
Problem/moderate risk gamblers	40	27.50 (14.60 to 43.89)	72.50 (56.11 to 85.40)	3.37	1.00 to 11.29	0.05
Low risk/no problems	1,161	10.42 (8.72 to 12.32)	89.58 (87.68 to 91.28)	1.19	0.80 to 1.77	0.38
Nongambler	681	10.43 (8.23 to 12.97)	89.57 (87.03 to 91.77)	–	–	–

AED, alcohol and energy drink; ED, energy drink.
[a]Reference category = nonuser (no ED or AED use).
[b]CI = 95% confidence interval. CIs for percentages were calculated according to the method described by Newcombe (1998).

drinks and 2.1 EDs. Participants recruited through mobile phones (6.7%, $n = 67$) were more likely to report AED use than participants recruited through landline telephones (2.4%; $n = 24$). Of those participants who reported consuming AEDs, the majority (70.3%; $n = 64$) reported less than monthly use, 17.6% ($n = 16$) reported using 2 to 4 times in a month, 6.6% ($n = 6$) reported using 2 to 3 times a week, 2.2% ($n = 2$) reported using 4 or more times a week, and 3.3% ($n = 3$) reported daily use.

Bivariate analyses examining AED use revealed similar predictors to ED use, with the odds of being an AED user increasing as a function of male gender (OR = 2.70, CI = 1.67 to 4.36, $p < 0.001$), living in a metropolitan area (OR = 2.27, CI = 1.29 to 4.00, $p = 0.004$), reporting moderate (compared to low) levels of psychological distress (OR = 4.37, CI = 2.70 to 7.09, $p < 0.001$), daily smoking (OR = 2.07, CI = 1.17 to 3.64, $p < 0.012$), moderate risk/problem gambling (OR = 3.89, CI = 1.77 to 8.52, $p = 0.001$), being aged 18 to 24 (OR = 35.11, CI = 15.92 to 77.43, $p < 0.001$) and 25 to 39 (OR = 12.86, CI = 5.75 to 28.75, $p < 0.001$), compared to 40+, and to report binge drinking 2 or more times a week (OR = 29.37, CI = 12.57 to 68.55, $p < 0.001$), 2 to 4 times a month (OR = 32.74, CI = 14.16 to 75.67, $p < 0.001$), and monthly or less (OR = 11.98, CI = 4.91 to 29.22, $p < 0.001$), compared to never. AED users were also more likely to have completed some secondary education (OR = 2.94, CI = 1.44 to 6.02, $p = 0.003$)

Table 2. Alcohol and Energy Drink Users ($n = 91$) Compared to Nonusers ($n = 1,696$)[a]

	n	% AED users (CI[b])	% non-AED users (CI)	OR	CI	*p*
Gender						
Male	742	8.22 (6.35 to 10.44)	91.78 (89.56 to 93.65)	1.95	0.78 to 3.87	0.06
Female	1,045	2.87 (1.95 to 4.07)	97.13 (95.93 to 98.05)	–	–	–
Age						
18 to 24	178	26.40 (20.09 to 33.52)	73.60 (66.48 to 79.91)	35.11	15.92 to 77.43	<0.001
25 to 39	377	9.28 (6.55 to 12.67)	90.72 (87.33 to 93.45)	12.86	5.75 to 28.75	<0.001
40+	1,222	0.74 (0.34 to 1.39)	99.26 (98.61 to 99.66)	–	–	–
Place of residence						
Metro	1,210	6.12 (4.83 to 7.62)	93.88 (92.38 to 95.17)	1.86	0.90 to 3.83	0.09
Nonmetro	577	2.95 (1.73 to 4.68)	97.05 (95.32 to 98.27)	–	–	–
Education						
Less than secondary education	400	2.75 (1.38 to 4.87)	97.25 (95.13 to 98.62)	0.92	0.28 to 2.99	0.89
Completed secondary education	357	10.08 (7.16 to 13.69)	89.92 (86.31 to 92.84)	0.86	0.27 to 2.75	0.80
Some postsecondary education	400	4.00 (2.30 to 6.41)	96.00 (93.59 to 97.70)	0.99	0.32 to 3.04	0.99
Completed degree	578	4.50 (2.96 to 6.52)	95.50 (93.48 to 97.04)	–	–	–
Income (pretax)						
Refused	239	2.93 (1.19 to 5.94)	97.07 (94.06 to 98.81)	1.83	0.37 to 9.14	0.46
Do not know	174	11.49 (7.16 to 17.19)	88.51 (82.81 to 92.84)	4.12	1.52 to 11.14	0.01
<$20,000	165	2.42 (0.66 to 6.09)	97.58 (93.91 to 99.34)	0.50	0.04 to 7.10	0.61
$20,000 to $40,000	271	4.80 (2.58 to 8.06)	95.20 (91.94 to 97.42)	2.01	0.70 to 5.74	0.19
$40,000 to $80,000	426	5.87 (3.83 to 8.54)	94.13 (91.46 to 96.17)	1.39	0.55 to 3.56	0.49
$80,000+	512	4.30 (2.71 to 6.43)	95.70 (93.57 to 97.29)	–	–	–
General health						
Excellent/very good	994	4.53 (3.32 to 6.01)	95.47 (93.99 to 96.68)	0.79	0.20 to 3.13	0.74
Good/fair	716	5.87 (4.26 to 7.85)	94.13 (92.15 to 95.74)	0.70	0.18 to 2.74	0.61
Poor	72	4.17 (0.87 to 11.70)	95.83 (88.30 to 99.13)	–	–	–
Psychological distress						
High	61	4.92 (1.03 to 13.71)	95.08 (86.29 to 98.97)	1.17	0.17 to 7.92	0.87
Moderate	385	11.69 (8.65 to 15.33)	88.31 (84.67 to 91.35)	2.74	1.42 to 5.26	0.01
Low	1,338	3.14 (2.27 to 4.22)	96.86 (95.78 to 97.73)	–	–	–
Smoking						
Daily smoker	229	9.61 (6.12 to 14.18)	90.39 (85.82 to 93.88)	1.18	0.50 to 2.80	0.71
Occasionally	62	9.68 (3.63 to 19.88)	90.32 (80.12 to 96.37)	0.91	0.29 to 2.89	0.88
Past smoker	429	2.80 (1.45 to 4.84)	97.20 (95.16 to 98.55)	0.93	0.36 to 2.38	0.88
Never smoked regularly	1,065	4.69 (3.50 to 6.14)	95.31 (93.86 to 96.50)	–	–	–
Binge drinking (past 3 months)						
2 or more times a week	166	16.27 (11.00 to 22.78)	83.73 (77.22 to 89.00)	24.17	6.96 to 84.57	<0.001
2 to 4 times a month	202	16.83 (11.95 to 22.72)	83.17 (77.28 to 88.05)	27.24	8.09 to 91.80	<0.001
Monthly or less	267	7.12 (4.34 to 10.89)	92.88 (89.11 to 95.66)	8.36	2.87 to 26.25	<0.001
Never	1,146	0.79 (0.36 to 1.49)	99.21 (98.51 to 99.64)	–	–	–
Gambling						
Problem/moderate risk gamblers	36	19.44 (8.19 to 36.02)	80.56 (63.98 to 91.81)	4.94	1.17 to 20.94	0.03
Low risk/no problems	1,096	5.11 (3.88 to 6.58)	94.89 (93.42 to 96.12)	1.78	0.96 to 3.39	0.07
Nongambler	633	3.63 (2.32 to 5.40)	96.37 (94.60 to 97.68)	–	–	–

AED, alcohol and energy drink; ED, energy drink.
[a]Reference category = nonuser (no ED or AED use).
[b]CI = 95% confidence interval. CIs for percentages were calculated according to the method described by Newcombe (1998).

and not know their income (OR = 2.78, CI = 1.39 to 5.56, $p = 0.004$).

Multivariate logistic regression analysis, as detailed in Table 2, showed that AED users were more likely to be younger, score moderate (as opposed to low) levels of psychological distress, binge drink, be moderate risk/problem gamblers, and not know their income. Male gender ($p = 0.06$) and living in a metropolitan area ($p = 0.09$) showed trend-level associations with AED use, while there were no significant differences between groups in terms of education level or smoking status.

DISCUSSION

This study sought to identify rates and patterns of ED and AED use and characteristics of ED and AED users in light of the significant growth in the ED market in Australia over the past 15 years, and the comparatively high population consumption of EDs in Australia. However, the results show that ED and AED consumption at a population level, although high in comparison with other countries (Zest Health Strategies, 2012), is still relatively modest. We found that 13.4% of participants had consumed EDs, and 4.6% had consumed AEDs, in the past 3 months. The only similar study, undertaken by Berger and colleagues (2011) in the United States, found that 26.3% of Milwaukee residents reported ED consumption and 6.3% reported AED consumption in the past 12 months. These are higher rates but based on a longer time frame (over 12 months rather than 3 months). Much higher rates of ED and AED use have been identified in subpopulations such as younger Australians (Droste et al., 2014; Peacock et al., 2012, 2013) and U.S. college students (Brache and Stockwell, 2011; Malinauskas et al., 2007; Miller, 2012; O'Brien et al., 2008; Velazquez et al., 2012; West et al., 2006), which is consistent with our finding that ED and AED users are more likely to be younger (aged 18 to 24 years).

While 1 in 7 people interviewed reported ED use in the past 3 months, the majority of these participants reported infrequent use, most typically monthly or less than monthly use. However, approximately one-third of ED consumers reported using EDs more regularly than monthly, and 1.6% of the total sample reported daily ED use. Of those participants who reported consuming AEDs, most reported monthly or less than monthly use, with very few reporting weekly or daily use. These patterns of use are consistent with the findings of Peacock and colleagues (2012, 2013), despite their sample comprising younger Australians than the current study. In our study, participants reported consuming approximately 4.7 alcoholic drinks and 2.1 EDs during a typical session, which is close to the thresholds set by the Australian National Health and Medical Research Council for risky drinking—no more than 5 drinks per day (NHMRC, 2009), and guidelines set by the Australia New Zealand Food Authority—no more than 2 EDs per day (Australia New Zealand Food Authority, 2009). These findings suggest that most Australian adults are not consuming AEDs at risky levels. However, it is important to note that some research has shown that particular subpopulations are likely to use much higher quantities of AEDs including U.S. college athletes (Woolsey, 2010; Woolsey et al., 2010), Australian ecstasy users (Sindich and Burns, 2010), and some younger Australian consumers (Peacock et al., 2012, 2013; Pennay and Lubman, 2012).

Our analyses revealed that ED consumers and AED consumers differ in some respects in terms of their sociodemographic characteristics. Compared to non-ED users, ED users are more likely to be male, be young, live in a metropolitan area, smoke, and be classified as a moderate risk/problem gambler. Compared to non-AED users, AED users are more likely to be young, experience moderate (as opposed to low) levels of psychological distress, binge drink, be moderate risk/problem gamblers, and not know their income (potentially because they may be students and/or work casually or part time). Our findings in relation to these demographic characteristics are similar to the previous studies exploring the predictors of ED and AED use, particularly in relation to age, gender, and living in a metropolitan area (Berger et al., 2011; Droste et al., 2014). In addition, while the findings of our study and of Trapp and colleagues (2013) indicate that smoking is associated with ED use, we did not find that alcohol consumption is associated with ED use. We found that "binge drinking" (drinking more than 5 drinks on a day) predicted AED use, which is consistent with existing research linking AED consumption with increased alcohol use (Brache and Stockwell, 2011; O'Brien et al., 2008; Velazquez et al., 2012). However, our findings also identified 2 predictors not previously associated with both ED and AED use; that is, moderate levels of psychological distress (as opposed to low) predicted AED use, and moderate risk/problem gambling predicted both ED and AED use.

To our knowledge, there is no previous research identifying a relationship between AED use and psychological distress. We know from existing research that AED use is associated with greater levels of drinking (Brache and Stockwell, 2011; O'Brien et al., 2008; Velazquez et al., 2012) and that alcohol consumption is associated with increased rates of depression and anxiety (Burns and Teeson, 2002). Previous research has also identified a link between ED use (without alcohol) and anxiety (Trapp et al., 2014) and caffeine use and poor mental health (Hovermale Simmons, 1996; Lucas et al., 2011). However, it is unclear whether AED use might be a risk factor for psychological distress or whether psychological distress may be a risk factor for AED use. Given the absence of research exploring the link between AED use and psychological distress, further research is required to investigate this association and to understand the direction of the relationship.

The association between ED and AED use and problem gambling is also a novel finding. This association intuitively makes sense if one considers that the caffeine in EDs might

result in higher impulsivity before or during gambling or be used to prolong wakefulness and attention while gambling. However, while there is a solid body of evidence suggesting a link between alcohol consumption and gambling (Maccallum and Blaszczynski, 2003; Petry et al., 2005), there is a surprising absence of human research exploring the link between caffeine and gambling, despite animal studies suggesting increased impulsive decision-making after acute caffeine administration (Diller et al., 2008; Flora and Dietze, 1993). It is likely that there is a cluster of problem behaviors for educated young men who live in urban areas, including ED use, problem gambling, binge drinking, smoking, stimulant drug use, and impulsivity (Ferris and Wynne, 2001). As such, more work is needed to explore the association between ED and AED use and gambling and their interaction with other characteristics of problematic gambling behavior such as long sedentary periods, mood disturbance, and obesity (Black et al., 2013; Lorains et al., 2011).

There are some limitations with this study that must be considered when interpreting the findings. These include the self-reported and retrospective nature of the survey, the potential for nonresponse bias and in particular that nonresponders may be higher users of alcohol and other drugs, potentially extending to EDs. However, a key strength of the study was the dual-frame (landline and mobile) nature of the survey, with previous work showing that mobile phone respondents report higher levels of substance use (Livingston et al., 2013). In addition, while the study has identified a number of associations, the cross-sectional nature of the design means causation cannot be suggested and when considering the AED findings, it is important to consider that these associations may be related to alcohol, as we did not compare alcohol-only consumers with AED consumers. We also did not compare AED-only users with dual users (i.e., AED users who also reported ED use), as a larger sample would have been required to separate the AED group in this manner. Finally, given the small size of the AED group, it is possible that some of the similarities observed could reflect a lack of statistical power to detect significant differences between groups. As such, these results should be considered preliminary and will require replication in a much larger sample.

CONCLUSION

This is the first Australian study, and to our knowledge the first non-U.S. study, to examine the prevalence and patterns of ED and AED use, and sociodemographic characteristics of ED and AED users, using a representative population sample. The findings suggest that EDs and AEDs are not used by the majority of the population and are used infrequently and in moderation among those who do consume them. ED and AED users are more likely to be aged 18 to 24 years, live in a metropolitan area, and be moderate risk or problem gamblers. AED users are also more likely to report moderate levels of psychological distress. Our findings in relation to psychological distress and problem gambling are novel and require further targeted investigation. In the meantime, health promotion strategies directed toward reducing ED and AED use should focus on young people living in metropolitan areas and could potentially be disseminated through locations where gambling takes place.

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