Drug and Alcohol Dependence 205 (2019) 107603

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

# Drinking to go out or going out to drink? A longitudinal study of alcohol in night-time entertainment districts

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ARTICLE INFO

*Keywords:*
Alcohol use
Night-time entertainment districts
Preloading
End-of-night
Longitudinal study
Legislation

ABSTRACT

*Background:* Recent research has highlighted the growing trend of alcohol preloading before a night out. We wished to look at people's motivations for preloading, their estimation for drinking during the night, and assess the impact that preloading has on how inebriated people become across the night as measured by Breath Approximated blood Alcohol Content (BrAC).

*Method:* We randomly surveyed and breath-tested patrons as they entered and exited Night Time Entertainment Districts (NEDs) in Brisbane, Queensland. We obtained 360 participants who were encouraged to contact us at the end of their night, compensating them for their time with a taxi voucher. Of these, 143 people returned and completed an exit questionnaire.

*Findings:* We found that people were motivated to preload in order to save money and socialise, were likely to drink more than they predicted over the course of the night, and were more surprised by their alcohol reading the higher their BrAC; this trajectory displayed little difference between men and women. It was further found that, for men, personality contributed 19% of the variance to exit BrAC, but entry BrAC accounted for nearly 38% of unique variance. For women, body mass index significantly predicted exit BrAC (9% unique variance), but entry BrAC accounted for nearly 30% unique variance.

*Interpretation:* To reduce general levels of intoxication in city NEDs, interventions should focus on having people come in earlier, less drunk, and be taught to have more realistic appraisals of their drinking.

## 1. Introduction

Alcohol has long been an integral part of social practice, with almost all known cultures having some recorded history of alcohol use as a means of integration and tribal ritual (McGovern, 2009). The production of alcoholic beverages has now been industrialised, with global reviews estimating the net revenue of the 26 largest alcoholic beverage companies to be $155 billion USD (Jernigan, 2009). Whilst collective motivations may vary, the popularity of alcohol consumption may plausibly be attributed to the 'positive' effects of alcohol consumption such as relaxation, body warmth and altered mood (Centers for Disease Control and Prevention, 2015) and facilitated by the widespread availability of the drug.

### 1.1. Burden of alcohol use

Despite these desired effects, numerous studies have demonstrated the detrimental effects of alcohol— effects which have typically been associated with increased quantity and frequency of consumption (Rehm et al., 2009; Wood et al., 2018). National evaluations of economic costs in Australia, specifically, have also demonstrated the potential detrimental effect of alcohol misuse with a cost-to-society estimated to be $14.35 billion (Manning et al., 2013; See S1, 1.1, for more details).

### 1.2. Study overview

Whilst the studies mentioned above provide insight into alcohol use and cost at a global level, less is known about consumption at an individual level over the course of a night in entertainment districts,

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https://doi.org/10.1016/j.drugalcdep.2019.107603
Received 6 March 2019; Received in revised form 30 July 2019; Accepted 31 July 2019
Available online 29 September 2019

leaving us with few intervention options at a societally or clinically useful level. The primary purpose of the current study was to look at alcohol intoxication predictors when people exit night-time entertainment districts (NEDs) using variables assessed from those same people as they entered the NEDs. NEDs are localised areas of high-density pubs and clubs and nightlife focused amenities, usually with commensurate public safety resources allocated by the local government or council. In Queensland, Australia, NEDs tend to also be designated as Safe Night Precincts.

Whilst NEDs are typically renowned for higher rates of alcohol consumption, specifics remain unknown or have received limited examination. In the current study, we aimed to gauge alcohol use around NEDs longitudinally by assessing degree of intoxication upon entry into, and at exit from, NEDs. The research also examined two variables that may add understanding of drinking behaviours which may be used for later interventions: motivations for alcohol use and accuracy of consumption estimation across a night. Finally, predictors of end-of-night intoxication will be examined, as this has frequently been tied to violence and, therefore, is a focus for legislative intervention (e.g., Mazerolle et al., 2012).

### 1.3. Preloading

Recent research investigating alcohol use in Queensland NEDs (Devilly et al., 2017) has found these districts to be particularly populated on Thursday, Friday, and Saturday nights by individuals typically in their early 20 s ($M_{age}$ = 22.61, $SD$ = 5.49). Preloading (also referred to as "pre-drinking", "pre-gaming" or "pre-partying") occurs when people consume alcohol, individually or in groups, prior to entering NEDs, typically in a private house, hotel or suburban pub (Devilly, 2018; Devilly et al., 2017; Foster and Ferguson, 2014). This research into preloading found that, of the 2751 participants from Brisbane (the State capital of Queensland), more than 79% of people reported preloading, and 71% returned a breath approximated blood alcohol content (BrAC) greater than zero, with both figures showing little difference between genders. Further, and contrary to other research which used a retrospective methodology (see Devilly, 2018 for a discussion of this), it was found that the primary reason for preloading was 'to socialise', with 'to save money' being a close secondary reason. Seminal research in the United States (e.g., Borsari et al., 2007; Chaney et al., 2019) has demonstrated that preloading (or pregaming, as termed there) is a unique predictor of intoxication and addiction in mandated students. Such results lead to questions regarding the role of preloading in city-wide intoxication levels and end-of-night inebriation and possible violence. Such questions require longitudinal research.

### 1.4. Longitudinal research

Perhaps the most comprehensive longitudinal assessment of alcohol consumption was completed by Wells et al. (2015) in Canadian NEDs. The authors assessed 287 patrons, both as they entered and exited popular NEDs. A particular strength of the research was that they breathalysed and administered surveys at both points of contact with participants. Whilst the researchers reported that 51% of participants preloaded, no entry BrAC analyses were reported and so differences at intake (e.g., gender or age differences) could not be appraised. The average BrAC at end of the night was reported to be a BrAC of 0.08%. However, this research only completed assessments between 10 pm and 12:30am, and we have found in our prior research that *entry* into popular NEDs in Queensland is well after 10 pm, and there is a significant, but very small, linear relationship between time of the night and BrAC readings– a relationship which, admittedly, only accounts for a shared variance of 1.44% ($r$ = .12; Devilly et al., 2017). An ideal longitudinal study into drinking in the NEDs, therefore, should be naturalistic and assess people as they leave the NEDs no matter what time that may be.

Research examining the impact of preloading across a night of drinking has generally produced uniform results, suggesting a positive association between pre-drinking and total alcohol consumption (e.g., Ostergaard and Skov, 2014; Kuntsche and Labhart, 2013; see S1, 1.4, for more detail). Overall, this research suggests a positive association between preloading and alcohol consumption. However, no study could be found utilising BrAC as a measurement of pre-drinking or of end of night intoxication. The current study will build upon these studies by directly assessing the degree of intoxication of patrons at entry and exit of NEDs across their night out, while also measuring other factors likely to be related to the end of night BrAC. In this regard, drinking motivations have been found to predict alcohol consumption.

### 1.5. Drinking motivations

Utilising the Revised Drinking Motivation Questionnaire (DMQ-R; Cooper, 1994), Ruiz et al. (2015) found that individuals with a dependency on alcohol were primarily motivated to consume alcohol for enhancement and coping, whilst those without dependency concerns primarily utilised alcohol for social and enhancement reasons. Mohr et al. (2005; and Koyama and Belli, 2011) found similar results to Oscar-Barman's non-alcoholic controls in their investigation of American college students' motivations towards alcohol consumption. Indeed, numerous studies across cultures and age groups have applied the Theory of Planned Behaviour (TPB; Ajzen, 1991) to alcohol consumption. They have predominantly found intention to be a strong predictor of use and misuse of alcohol, explaining between 8–30% of variance in use (Barmpagianni et al., 2014; Kam et al., 2009; Marcoux and Shope, 1997). However, research exploring the application of the TPB to alcohol consumption has been limited to examining the outcome variable 'alcohol use' retrospectively. No studies could be found in the literature examining the ability of individuals to make an accurate *a priori* estimation of their intended consumption across a night of drinking, particularly in NEDs. We wished to address this research gap, along with a clarification of demographic variables that may affect drinking across the night.

### 1.6. Demographic issues

In looking at what predicts end of night intoxication levels in the NEDs, there are known differences in alcohol metabolism due to body mass (SA Health, 2012) and stage of lifespan (Meier and Seitz, 2008), and so we also need to assess these variables. Furthermore, males and females should be analysed separately due to known effects of gender on alcohol metabolism (e.g., Baraona et al., 2001; Kwo et al., 1998). We also have research pointing to a relationship between personality variables and binge drinking generally. These variables include: high impulsivity, high sensation seeking, anxiety sensitivity, neuroticism, extraversion, and low conscientiousness (Adan et al., 2017). However, nearly all this research has come from University students as participants and not a sample of patrons in the night-time economy. The obvious reason for this is the lack of time one has with such samples to get them to complete any meaningful personality measures while they are inebriated. However, with our methods of data collection (see Devilly, 2018), and the availability of short item personality questionnaires (e.g., the Ten Item Personality Inventory; Gosling et al., 2003), we believe that the most stable personality variables can now be approximated and considered in any model predicting end-of-night BrAC.

### 1.7. Study aims

In this study we wished to gauge the rate of preloading before entry into the NED, people's entry inebriation level, past drinking behaviour, predictions for their drinking behaviour once inside the NED, and their alcohol use status generally. We then wished to test the relationship between this entry data and their exit data: does the NED entry BrAC

predict their exit BrAC once known factors are taken into account? We further predict that individuals will underestimate their alcohol consumption across a night of drinking, and people will be more surprised by their BrAC reading the higher that reading goes. Lastly, we wished to inspect people's motivations for preloading.

## 2. Method

### 2.1. Participants and procedure

An *a priori* power analysis led us to require 164 participants (82 females and 82 males) to complete both entry and exit assessments (See S1, 2.1). This research was completed in conjunction with a larger overarching study that was completed in partnership with the Queensland Police investigating alcohol and illicit substance use in NEDs (manuscript in preparation). Refusal rate was 11.23%. Three hundred and sixty individuals (162 males and 198 females) completed the entry survey relevant to the current research, of whom 143 returned to complete the exit survey.

Following ethical approval (obtained through the Human Research Ethics Committee of Griffith University - 2015/704), participants were recruited at main bottlenecks into and out of popular Brisbane NEDs between 7:30pm and 5am. This included: train stations, taxi ranks, and outside entertainment venues. Recruitment occurred in the warmer months (between November 2015 and April 2016) on most Thursday, Friday, and Saturday nights (no data collection was completed over the Christmas holiday).

Every fourth individual was approached (or every individual after a rejection occurred) and was invited to participate in the study. Participants were given a brief introduction to the study before being invited to complete a survey. Researchers ensured all potential participants were entering the NED and had not consumed alcohol in the NED already. Those who had consumed alcohol in the NED were offered a breath test as a public service. Participants were also informed of a $20 taxi voucher incentive for completing the entry survey at the beginning of the night, as long as they returned to complete the leaving survey upon exit from the NED. To facilitate the return of participants to complete the exit survey, participants were provided with a mobile number (which was written on the ID cards) to text when they were ready to leave the NED. Upon doing so, an auto-response text message was sent to the participant informing them of the research team's current location. As a primary goal of the study was to estimate general alcohol consumption in entertainment districts, no exclusion criteria applied.

Similar to previous comparable research (e.g., Devilly et al., 2017, 2019), the majority of participants were in their early 20 s ($\bar{x}$ = 21.18 years, SD = 4.45). Most identified as students (52.1%), followed by 'professional role' employment (10.8%), followed by sales worker (7.2%), then labourer or managerial employment (both 6.1%).

### 2.2. Materials

#### 2.2.1. Apparatus

Individuals were breathalysed using the Alcolizer LE5, which is the only hand-held breathalyser which has been demonstrated to have good reliability and validity in field trials (Sorbello et al., 2018). All questionnaires were completed by participants on iPads using QuickTapSurvey.

#### 2.2.2. Surveys

The entry and exit surveys (see S1, 2.2.2 for more details) assessed: demographics and body mass index; personality (TIPI; Gosling et al., 2003); expected alcohol consumption whilst in the NED and actual drug and alcohol consumption before entry; alcohol drinking motivations–preloading and whilst in the NED; behavioural intentions at the end of the night; retrospective estimations of number of drinks consumed; and BrAC at entry and exit to the NED.

## 3. Results

### 3.1. Data diagnostics

Data was cleaned, and outliers were investigated (see S1, 3.1*). A logarithmic transformation was applied and appeared to resolve normality concerns for "age" (with so many 18- and 19-year-old patrons). All analyses were undertaken using SPSS 22.0 (IBM Corp., 2013), ClinTools 4.1 (Devilly, 2007a,b), and Statistica 13 (TIBCO Software, 2017).

### 3.2. Methodology check

Our 'return' sample did not significantly differ from our non-return sample on any of the important intake variables (personality, age, BrAC, number of people with a BrAC of zero). Those with a higher BMI were less likely to return (small effect), and our exit BrAC was less than the average BrAC at exit found in the overarching study up to that point (see S1, 3.2, for more details).

### 3.3. Intoxication across the night

Table 1 presents data for those who completed the entry survey, whilst Table 2 presents longitudinal data for those who completed both the entry and exit survey. Analyses are reported by gender and also combined. The average length of time spent in the NED (i.e., between the two assessments) by our sample was nearly 3 h ($\bar{x}$ = 2.92 h, sd = 1.48; min = .35, max = 6.47; median = 2.75; n = 138).

If one were to adopt the legal BrAC driving limit as a cut-off for intoxication (BrAC > .05%), one can see from Table 1 that 46.48% of our intake sample met this criterion, and 61.80% of preloaders scored above this cut-off. Males and females did not significantly differ in the rate of intoxication using this cut-off. In fact, the rates were exceptionally similar, whether seen as a proportion of those scoring above zero (Males = 61.16%; Females = 62.33%; $x^2[n = 267, df = 1] = 0.04$, $p = .84$, $Phi = .01$) or as a proportion of the entire sample (Males = 47.13%; Females = 45.96%; $x^2[n = 355, df = 1] = 0.05$, $p = .83$, $Phi = .01$). Another way of checking our sample at intake that was similar as those returning, and instructive under the rubric of 'intoxication across the night', is the number of people scoring above or below this intoxication criterium of .05% (yes / no) and those who returned (yes / no) for the follow-up. This was also not significant ($x^2[n = 355, df = 1] = 0.30$, $p = .58$, $Phi = .03$) and further supports our sampling methodology.

Eighty-five percent of participants reported that they had preloaded before entering the NED, though only approximately 74% of individuals assessed at entry had a BrAC reading greater than zero. Of those who endorsed preloading and later returned, 16 out of the 19 who had a zero BrAC reading reported to have had 2 or fewer standard drinks in the previous 2 h. Paired-sample t-tests revealed that individuals had higher

**Table 1**
BrAC readings at entry.

| Sample | Group | n | M(SD) | Median | Min | Max |
|---|---|---|---|---|---|---|
| Including BrAC Readings Of 0 | Combined | 355 | .051 (.05) | .046 | .00 | .212 |
| | Male | 157 | .054 (.05) | .047 | .00 | .112 |
| | Female | 198 | .049 (.05) | .044 | .00 | .203 |
| Only BrAC Readings Above 0 | Combined | 267 | .068 (.04) | .061 | .008 | .212 |
| | Male | 121 | .07 (.04) | .061 | .008 | .212 |
| | Female | 146 | .067 (.04) | .062 | .008 | .203 |
| Only BrAC Readings Above .05% | Combined | 165 | .092 (.04) | .082 | .051 | .212 |
| | Male | 74 | .094 (.04) | .082 | .051 | .212 |
| | Female | 91 | .09 (.034) | .085 | .051 | .203 |

**Table 2**
BrAC readings for longitudinal data (including BrAC zero readings).

| | *n* | *M* (*SD*) | *Median* | Min | Max |
|---|---|---|---|---|---|
| Combined | | | | | |
| Entry | 143 | .049 (.041) | .047 | .000 | .160 |
| Exit | 143 | .065 (.047) | .060 | .000 | .210 |
| ΔBrAC | 143 | .016 (.038) | .010 | −.065 | .119 |
| Absolute ΔBrAC | 143 | .031 (.027) | .027 | .000 | .119 |
| Male | | | | | |
| Entry | 56 | .048 (.041) | .049 | .000 | .155 |
| Exit | 56 | .069 (.046) | .066 | .000 | .190 |
| ΔBrAC | 56 | .021 (.037) | .014 | −.038 | .116 |
| Absolute ΔBrAC | 56 | .032 (.028) | .028 | .00 | .116 |
| Female | | | | | |
| Entry | 87 | .050 (.041) | .045 | .000 | .160 |
| Exit | 87 | .063 (.048) | .058 | .000 | .210 |
| ΔBrAC | 87 | .013 (.038) | .008 | −.065 | .119 |
| Absolute ΔBrAC | 87 | .030 (.026) | .022 | .000 | .119 |

BrACs at exit relative to entry $t(142) = 5.18$, $p < .001$, $g = 0.43$, with a moderate effect size observed. Participants estimated that on average they consumed 4.99 standard drinks (sd = 5.02) whilst they were in the entertainment district. Data were also analysed where they were limited to participants with BrACs greater than zero to examine data explicitly for those that had been drinking. Based upon the longitudinal data, no significant difference of BrAC at entry to NED was observed between males ($\bar{x} = 0.070$, sd = 0.042) and females ($\bar{x} = 0.067$, sd = 0.040), $t(265) = 0.63$, $p = 0.53$, $g = 0.08$ [-0.16, 0.32].

Similarly, males with a BrAC > 0 at exit ($\bar{x} = 0.076$, sd = 0.042; Table 2) were not significantly different to females with a BrAC > 0 at exit ($\bar{x} = 0.072$, sd = 0.044), $t(125) = 0.53$, $p = 0.60$, $g = 0.09$ [-0.26, 0.45]. BrAC readings were also analysed by time of night that individuals were entering or leaving the NED. For entry, a significant positive correlation was found, $r(359) = .19$, $p < .001$, although it explained only 3.69% of the variance (representing a relatively small effect size). However, no significant correlation between time of night and BrAC reading was observed for those leaving the NED with the relationship explaining only 1% of the variance, $r(138) = -.08$, $p = 0.36$.

Of particular interest to legislators, it was found that the length of time spent inside the NED was negatively correlated with BrAC at entry ($r(138) = -.28$, $p = .001$): the higher the BrAC of patrons at entry, the less time they spent in the city. It was also negatively correlated to a smaller degree with exit BrAC ($r(138) = -.18$, $p = .03$), although this may be a side effect of entry and exit BrAC being interdependent. However, time inside the NED was not significantly correlated with change in BrAC from entry to exit ($r(138) = -.10$, $p = .23$), which somewhat clarifies this issue.

**Table 3**
Hierarchical multiple regression analyses of exit BrAC using demographics, personality and entry BrAC as predictors.

| Analytic Approach | | Variable Statistics | | | | Model Statistics | | | |
|---|---|---|---|---|---|---|---|---|---|
| Gender | Model Step Variable | B | 95% CI | B | p | Model $R^2$ | Adjusted $R^2$ | Model F Change | Model p |
| Males | *Step 1* | | | | | | | | |
| | BMI | −.01 | −.01, .00 | −.28 | .04 | | | | |
| | lnAge | .05 | −.10, .21 | .10 | .48 | .08 | .04 | 2.18 | .12 |
| | *Step 2* | | | | | | | | |
| | BMI | −.01 | −.01, .00 | −.28 | .04 | | | | |
| | lnAge | .03 | −.12, .18 | .05 | .68 | | | | |
| | Extraversion | −.01 | −.01, .01 | −.08 | .54 | | | | |
| | Agreeableness | −.01 | −.01, .01 | −.03 | .83 | | | | |
| | Conscientiousness | −.01 | −.01, .00 | −.25 | .06 | | | | |
| | Emotional Stability | −.01 | −.01, .01 | −.14 | .33 | | | | |
| | Openness | −.01 | −.02, .00 | −.25 | .06 | .29 | .18 | 2.76 | < .03 |
| | *Step 3* | | | | | | | | |
| | BMI | −.01 | −.01, .00 | −.26 | < .01 | | | | |
| | lnAge | −.02 | −.12. .09 | −.03 | .74 | | | | |
| | Extraversion | −.01 | −.01, .00 | −.21 | .04 | | | | |
| | Agreeableness | −.01 | −.01, .01 | −.06 | .50 | | | | |
| | Conscientiousness | −.01 | −.01, .00 | −.07 | .47 | | | | |
| | Emotional Stability | −.01 | −.01, .01 | −.13 | .20 | | | | |
| | Openness | −.01 | −.01, .01 | −.24 | < .01 | | | | |
| | Entry BrAC | .64 | .46, .82 | .66 | .00 | .66 | .61 | 51.59 | < .001 |
| Females | *Step 1* | | | | | | | | |
| | BMI | −.01 | −.01, .00 | −.27 | < .01 | | | | |
| | lnAge | .23 | .1, .37 | .36 | < .01 | .17 | .15 | 8.10 | < .01 |
| | *Step 2* | | | | | | | | |
| | BMI | −.01 | −.01, .00 | −.28 | < .01 | | | | |
| | lnAge | .25 | .12, .39 | .39 | < .001 | | | | |
| | Extraversion | .01 | −.01, .01 | .12 | .31 | | | | |
| | Agreeableness | −.01 | −.02,-.01 | −.25 | .02 | | | | |
| | Conscientiousness | −.01 | −.01, .01 | −.06 | .59 | | | | |
| | Emotional Stability | .01 | −.01, .01 | .08 | .45 | | | | |
| | Openness | .01 | −.01, .01 | .08 | .48 | .26 | .19 | 1.84 | .12 |
| | *Step 3* | | | | | | | | |
| | BMI | −.01 | −.01, .00 | −.24 | < .01 | | | | |
| | lnAge | .16 | .05, .27 | .24 | < .01 | | | | |
| | Extraversion | .01 | −.01, .01 | .08 | .39 | | | | |
| | Agreeableness | −.01 | −.01, .00 | −.19 | .03 | | | | |
| | Conscientiousness | .01 | −.01, .01 | −.03 | .69 | | | | |
| | Emotional Stability | .01 | −.01, .01 | .08 | .32 | | | | |
| | Openness | .01 | −.01, .01 | .02 | .79 | | | | |
| | Entry BrAC | .89 | .42, .77 | .57 | .00 | .55 | .50 | 46.53 | < .001 |

*Note:* lnAge = normalised log Age; Coefficients less than .005 also rounded upward to .01.

**Table 4**
Self-reported motivations to consume alcohol prior to and whilst in NEDs.

| Motivation | Prior to Entry ($n$=306) | Whilst in NEDs ($n$=128) |
|---|---|---|
| 'Enjoy the feeling' | 7.5% ($n$=23) | 18.8% ($n$=24) |
| 'Pressure from friends' | 2.2% ($n$=7) | 0.8% ($n$=1) |
| 'Socialise with friends' | 28.1% ($n$=86) | 50.0% ($n$=64) |
| 'To feel more comfortable/relaxed' | 5.2% ($n$=16) | 10.2% ($n$=13) |
| 'Get as drunk as possible' | 6.5% ($n$=20) | 7.8% ($n$=10) |
| 'Increase confidence' | 1.0% ($n$=3) | 0.8% ($n$=1) |
| 'To save money' | 49.3% ($n$=151) | 11.7% ($n$=15) |

#### 3.3.1. Predictors of end of night BrAC

Hierarchical regressions were employed to examine the variance explained in BrAC at the end of the night by BrAC at entry to NEDs whilst statistically controlling for age and BMI and also personality variables. As explained above, separate analyses were undertaken for males and females. Agreeableness ($r$(143) = -.17) was the only personality variable which correlated significantly across the entire sample with exit BrAC.

Looking within each gender, conscientiousness ($r$(56) = -.34), emotional stability ($r$(56) = -.29), and openness to experiences ($r$(56) = -.28) correlated negatively with exit BrAC for males. Extraversion ($r$(56) = -.20) displayed a small, but non-significant, negative relationship with exit BrAC, while agreeableness ($r$(56) = -.09) did not relate for males.

For females, none of the personality variables significantly correlated with exit BrAC. Extroversion ($r$(87) = .17) and agreeableness ($r$(87) = -.20) demonstrated small, non-significant relationships, while conscientiousness ($r$(87) = -.03), emotional stability ($r$(87) = .08), and openness to experiences ($r$(87) = .03) did not relate for females. Due to the reduced power of analysing within each gender it was decided to include all the personality variables as a second step in the hierarchical regressions. This is a more conservative approach, leaving less unique variance available for the third step of the model. On the one hand we do not wish to saturate the model, carving variance with a thousand strokes, but on the other it does not appear a valid approach to exclude the one personality variable which correlated with outcome for the entire sample (agreeableness), because reduced power within each gender meant a lack of significance. Likewise, it does not give the impression of a level playing field if we were to analyse the males with a second step of personality and not the females.

#### 3.3.2. Males

BMI and logarithmically transformed age were entered first into the model prior to the personality variables being entered into the model at Step 2. BrAC at entry was entered into the model at Step 3. Table 3 provides a summary of the hierarchical regression analysis for males and females. Analysis revealed that Step 1 did not significantly contribute to the regression model ($R^2$ = .08, $F$(2, 52) = 2.18, $p$ = .12). The addition of Step 2 significantly added to the model ($\Delta R^2$ = .21, $F$(5,47) = 2.76, $p$ = .03). Analysis revealed that the second stage of the model, containing demographic and personality variables, was significantly different to zero ($R^2$ = .29, $F$(7,47) = 2.70, $p$ = .02). However, adding entry BrAC at Step 3 significantly added to the model again ($\Delta R^2$ = .38, $F$(1,46) = 51.59, $p$ < .001). This represents a very large effect size, and the resultant model was unsurprisingly different to zero ($R^2$ = .66, $F$(8,46) = 11.35, $p$ < .001). BrAC at entry was found to be the major significant predictor of BrAC at exit ($p$ < .001), representing a large positive prediction explaining 37.7% of unique variance. To place this in perspective, the unique variance contributed in a flipped model by personality variables at Step 3 was 19% and by the age and BMI variables at Step 3 was only 7.2%.

#### 3.3.3. Females

Variables were entered into the hierarchical regression model in the same order as males. In contrast to males, analysis revealed that Step 1 significantly contributed to the model ($R^2$ = .17, $F$(2, 79) = 8.10, $p$ = .001). The addition of personality variables at Step 2 did not significantly add to the model ($\Delta R^2$ = .09, $F$(5,74) = 1.84, $p$ = .12). Analysis revealed that the second stage of the model, containing demographic and personality variables, remained significantly different to zero but with a reduced effect ($R^2$ = .26, $F$(7,74) = 3.75, $p$ = .002). However, and similar to the analysis for males, adding entry BrAC at Step 3 significantly added to the model again ($\Delta R^2$ = .29, $F$(1,73) = 46.53, $p$ < .001). This represents a very large effect size, and the resultant model was also different to zero ($R^2$ = .55, $F$(8,73) = 11.12, $p$ < .001). BrAC at entry was found to be the major significant predictor of BrAC at exit ($p$ < .001), representing a large positive prediction explaining 29.7% of unique variance. As males, and to place this in perspective, the unique variance contributed in a flipped model by personality variables at Step 3 was only 4.7% and by the age and BMI variables at Step 3 was just 9%.

#### 3.3.4. Ancillary analysis

As personality variables may be correlated with entry BrAC, these correlations were also checked. Male entry BrAC significantly and negatively correlated with conscientiousness ($r$ = -0.26), and there were no significant correlations between personality variables and entry BrAC for females.

### 3.4. Motivation for drinking

Table 4 displays participant self-reported motivations to consume alcohol both prior to (preloading) and whilst in NEDs. 'To save money' followed by 'to socialise with friends' were endorsed to be the greatest motivators regarding preloading. 'To socialise with friends' followed by 'I enjoy the feeling' received the greatest endorsement as the primary motivating factor to drink alcohol whilst in the NEDs. The BrAC of people at entry and those at exit, and change in BrAC from entry to exit, was not significantly different between those who specified their primary reason for preloading was to save money and those who specified socialisation as the main reason for preloading (see Fig. 1). Considering the financial lure to return for exit interviews, it is not surprising that more of the people who at entry specified preloading 'to save money' returned at exit compared to those who specified 'to socialise'. However, this did not reach significance with two-tailed testing ($x^2$($n$ = 341, $df$ = 1) = 2.85, $p$ = .09).

### 3.5. Accuracy in drinking intentions and future intentions

A paired-samples $t$-test indicated that individuals reported drinking significantly more standard drinks whilst out ($\bar{x}$ = 4.99, sd = 3.48) than what they intended ($\bar{x}$ = 4.06, sd = 2.64), with a small to medium effect size observed ($t$(126) = 2.59, $p$ = .01; $g$ = 0.3 [.07, .053]). Number of intended drinks did correlate with change in BrAC from entry to exit ($r$($n$ = 139) = .25, $p$ = .003).

Participants were also asked whether they intended to 'endload' (continue drinking after leaving the NED) as they were leaving the NED. 20.28% intended to endload, and there was a higher percentage of males intending to endload than women, but this did not quite reach significance ($x^2$($df$ = 1, $n$ = 143) = 2.41, $p$ = .12, $Phi$ = .13). The most frequently cited place to endload was 'at home' (44.83%), followed by 'at another venue in a different suburb' (24.14%) and 'at a friend's house' (17.24%). Intention to endload was not significantly differentiated by exit BrAC ($F$(1, 141) = 2.22, $p$ = .14), although it should be noted that only 29 participants intended to endload. With a possible effect size of $g$ = 0.31 [-.1, 0.7] and a counternull (Rosenthal and Rubin, 1994) of $g$ = 0.62, this requires further clarification.

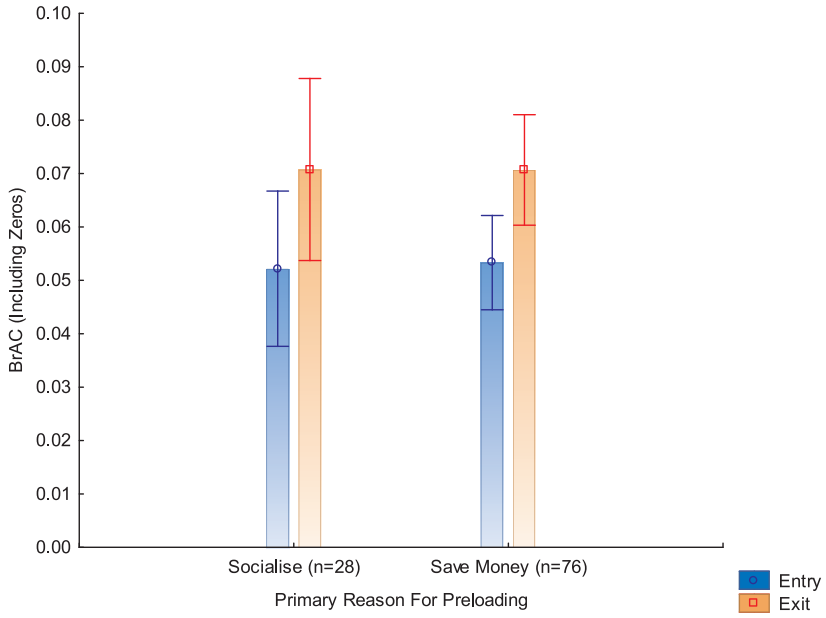


**Fig. 1.** BrAC at entry and exit, by motivation to preload.

### 3.6. Reaction to BrAC reading

After being breathalysed on entry to the NED and given their BrAC reading, the participants were asked whether the reading surprised them. A one-way ANOVA with 'Surprise' rating as the independent variable and entry BrAC as the dependent variable was highly significant ($F(4, 350) = 3.71, p = .006$). As demonstrated in Fig. 2, people were increasingly surprised by their rating as they obtained higher inebriation scores.

## 4. Discussion

The broad aim of the current research was to assess alcohol consumption behaviours within night time entertainment districts (NEDs) by: investigating alcohol use longitudinally across a night in the NED; examining variables that may be utilised for later interventions; and exploring the contribution of preloading to end-of-night intoxication.

The results of the current study generated considerable differences when examining preloading in an Australian NED context relative to previously conducted research. Specifically, whilst recent research conducted in the UK found that approximately a quarter to a third of individuals preloaded on the sample nights (McClatchley et al., 2014), the results of the current research revealed that 85% of NED patrons endorsed preloading on that night. The endorsement rate found in the current research was also considerably higher than research conducted in a Canadian sample that revealed approximately half of patrons preloaded (Wells et al., 2015). Our preloading rate is, however, consistent with our other, more large scale, studies from the same locations (Devilly et al., 2017, 2019). These sizable disparities may be attributed to cultural differences between the samples. Furthermore, the greater endorsement rate in the current sample may be further explained due to the comprehensive sampling utilised in the current research.

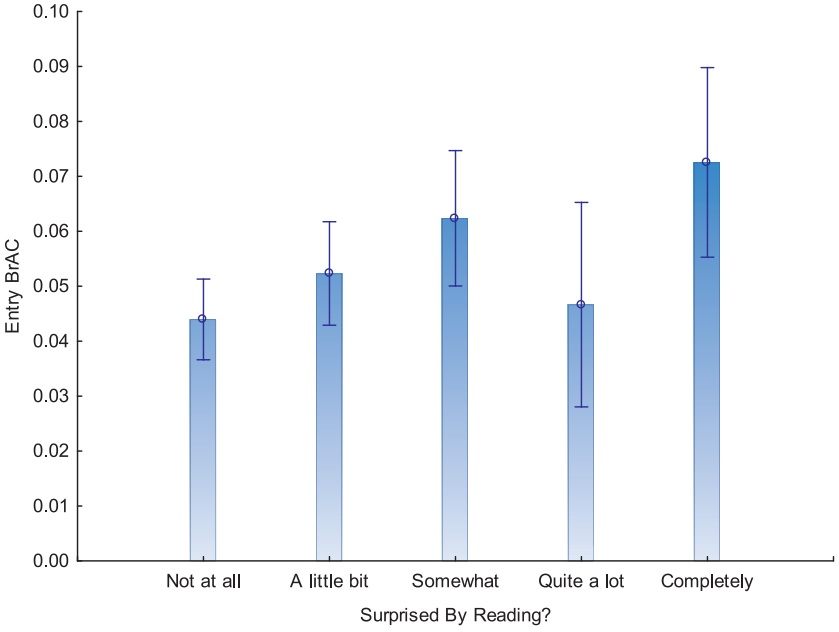


**Fig. 2.** Surprise by entry BrAC reading as a function of entry BrAC.

Specifically, the current study sampled individuals from 7:30pm to 5am across numerous nights of the week, whilst previous research was limited to sampling until approximately midnight.

It was also found that people had higher BrACs on exit compared to on entry. While this may seem an obvious result, it should be pointed out that the effect size was only small to moderate. Time spent inside the NED was correlated with entry BrAC and, to a smaller degree, exit BrAC. However, and in light of the hierarchical regressions, it is evident that this relationship between Exit BrAC and time spent inside the NED is mostly related to their entry BrAC. In support of this hypothesis, it was found that the change in BrAC from entry to exit was not correlated with how long the patrons had been inside the NED. In effect, it appears that assumed inebriation level at entry to the NED is the stronger determinant for how long people stay inside the NED: the higher their BrAC at entry, the less time they spend inside the NED.

Relatedly, Exit BrAC was predicted in males by body mass index (but not age) and by some personality variables (specifically, extraversion and openness to new experiences). However, the lion's share of variance was attributable to entry BrAC, accounting for 37.7% of unique variance in exit BrAC. For females, while BMI predicted exit BrAC, so did age. Personality variables added little to the prediction (agreeableness was the only one to significantly add to the model), but entry BrAC was again a very large predictor, accounting for 29.7% of unique variance in exit BrAC. That we can account for more than 50% of the variance in Exit BrAC, while using a conservative approach to the analysis (i.e., including all variables for both males and females) and not saturating the model, more than outweighs the reduced sample sizes required when analysing by genders. In effect, the old adage that the best predictor of future behaviour is past behaviour rings true again. This result is consistent with those of Borsari et al. (2007) and with PRIME theory (West, 2007). If preloading with alcohol is primarily a system for socialisation, then one would expect that the behaviour of entering NEDs with other people is demonstrative of our motivations to continue drinking whilst still socialising. That said, most of the people we spoke to oscillated between 'to socialise' and 'to save money'. In our previous research where people could select multiple reasons for preloading, these two reasons were selected in 49.54% (to socialise) and 44.12% (to save money) of answers (Devilly et al., 2017).

In relation to the Theory of Planned Behaviour, we found that people were likely to drink more than they had planned and, at entry, were increasingly surprised by their BrAC reading the higher that reading registered. That said, the mean difference between what they intended to drink and what they actually reported to have drunk was less than 1 drink on average. Furthermore, the number of intended drinks whilst inside the NED did correlate with change in BrAC from entry to exit. People underestimating their future drinking predicted change in inebriation from entry to exit. With increasing inebriation levels being associated with increasing surprise at their BrAC score, it seems that entry into the NED may offer a timely avenue for intervention.

Endloading intentions were endorsed by more than 20% of people who returned at exit. While not of statistical significance in the current research, we believe that it is worth following-up on these statistics in future research, as it may be that those with intentions to endload may have higher BrACs and/or be more behaviourally inebriated. Consistent with Ostergaard and Skov (2014) and Kuntsche and Labhart (2013), it appears throughout all of our results that it is the people who pre-drink the most that continue to drink most throughout the night and into the morning.

Those who returned at exit were not significantly less inebriated at entry than those who did not return, as measured by BrAC. Those returning were also no more or less inclined to have scored zero at entry. However, we believe that it is likely that those who returned were more able to send a text and interact with their phone than those who did not. As such, it is likely that our return sample were less behaviourally inebriated than the non-return sample at NED exit. Indeed, compared to a sample of people who were breathalysed at exit as part of another, broader, study, our sample scored lower BrACs. This is unavoidable when obtaining a random sample at entry into the NED and trying to track these people through to NED exit. That said, we believe that the current study may only be underestimating the effect of intake BrAC on exit BrAC. With personality and demographic variables contributing so little in unique variance to exit BrAC, the fact that we may have been under-represented by the higher BrACs in our exit data does not detract from the main results in this research. To the contrary, we would argue that our results would only be stronger if we were more represented at exit by those with the highest BrACs. We believe that the small degree of uncertainty introduced by this lack of returns by the 'top ends' of inebriation is more than compensated for by the ecological validity inherent to our study design.

The results of the current research hold implications for future interventions related to alcohol consumption— specifically in NEDs. Subsequently, these interventions may in turn affect previously cited consequences of alcohol consumption at hazardous levels (e.g., crime, health, and productivity; Manning et al., 2013). These interventions may include addressing public policy, policing practices in NEDs, and individual interventions. Whilst it is beyond the scope of the current research to begin to outline specific public policies that may be employed, broad principles based upon the results of the current research may add to the efficacy of these interventions. The results of this study clearly explicated the need to target drinking behaviours at point of contact rather than simply basing interventions on time of night. For example, if motivations are to be addressed, these must be unique to preloading or drinking whilst in NEDs. Furthermore, if the aim of these interventions is to reduce intoxication levels of individuals leaving NEDs, preloading must be addressed given the magnitude of its predictive power. Additionally, interventions aimed at assisting individuals to track their consumption may be pertinent, given that individuals in the current research drank significantly more than intended and, at entry to the NEDs, were increasingly surprised by their BrAC readings. Realistic appraisal of one's inebriation level may even be consequently related to assault rates within the NED, as suggested by Devilly et al. (2017).

In conclusion, the current research holds value for the currently dynamic landscape of entertainment district, safe-consumption policies. With various policies being proposed and implemented, we believe that these should be based upon ecologically valid research. If assertions are to be made regarding safe drinking practices, their basis and aim must be made clear so that their efficacy may be appropriately evaluated. From our research, it seems that people who drink to go out then carry on drinking once they are out.

## Role of funding source

$39,800 National Drug Strategy Law Enforcement Funding Committee (Last Drinks Project). Alcolizer Technology provided consumables for testing and calibrated the breathalysers.

## Licence to publish



## Ethics committee approval

Approved by Griffith University Human Research Ethics Committee 2015/704

## Data sharing

All data will be made available to other researchers.

## Contributors

Devilly obtained funding, managed the larger research programme, designed the research, collected data, analysed the data and wrote the manuscript. Allen also obtained funding, managed the larger research programme, designed the research, collected data, and contributed to revisions of the manuscript. Greber refined the design and procedure, collected the data and contributed to analysing the data and writing the manuscript. Brown also helped to refine the design and procedure, collected the data and contributed to revisions of the manuscript. All authors have contributed to and approved the final manuscript.

## Transparency Declaration

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

## Declaration of Competing Interest

None. In particular, we have not received any funding during this research from local or state governments, political organisations, lobby groups, temperance societies and health based registered charities, or companies involved in the supply or sale of alcohol.

## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2019.107603.

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