Are you okay to drive? Commuting behaviour and blood alcohol concentrations amongst restaurant diners

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Title

Are you okay to drive? Commuting behaviour and blood alcohol concentrations amongst restaurant diners

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Are you okay to drive? Actual and intended commuting behaviour and blood alcohol concentrations amongst restaurant diners

Abstract

Objective

Drink driving is widely recognised as a major road safety problem. In Australia, health promotion messages encourage monitoring the number of standard drinks consumed prior to driving. The pilot research aimed to investigate commuting behaviour and blood alcohol concentration (BAC) of diners, including intended-drivers, at Sunshine Coast restaurants.

Methods

Five hundred and forty-four diners \((n = 260\) males) consented to participate in a brief interview and to use a breathalyser device to measure their BAC.

Results

Forty percent of participants advised they don’t drink and drive (34% of males, 45% of females; 67.25% of <17-20 years, 30.5% of 50-59 years), and of the remaining participants, 75% advised they count the number of their drinks (69% of males, 84% of females; 32% of <17-20 years, 82% of 50-59 years) while 10% of participants monitored their BAC by how they were feeling (12% of males, 6% of females). Thirty-seven percent of participants said it was easy/very easy to estimate their BAC (41% of males; 33% of females; 21% of <17-20 years, 43% of 50-59 years). The actual BAC was less than expected for 56% of participants, with one third underestimating BAC and some intended-drivers having an actual BAC in excess of the 0.05 limit.

Conclusions

Given the proportion of diners who reported they count the number of drinks, or use feelings as a way to gauge BAC, coupled with the considerable proportion who underestimated their BAC, a safer public health message is to avoid driving if you intend to drink. In addition,
targeted intervention for experienced drivers (and, arguably, drinkers) appears warranted as every participant aged less than 21 years who stated they would drive home indeed had a zero BAC. Interestingly every female driver who stated they would be driving home also had a legal BAC, suggesting gender-specific intervention.
Introduction

Drink driving remains a leading cause of road fatalities and injuries in Australia (Terer & Brown, 2014), despite a mandatory maximum blood alcohol concentration (BAC) of 0.05 (50 milligrams of alcohol per 100 millilitres of blood) being legislated and enforced for more than a quarter of a century (Australian Bureau of Statistics, 2001). Despite the enforcement of this BAC through random breath testing (RBT), during the inclusive period 2006-2010, crash estimations reveal that 19,413 in Australia involved a drinking driver/rider. Of these crashes, 8.3% resulted in one or more fatalities, and 44.9% resulted in serious injuries (Bradshaw et al., 2015). In the Australian state of Queensland in the 2015 calendar year, 23.5% of fatalities and 7.7% of hospitalisations across the state involved a drinking driver/rider (TMR, 2017). BAC levels are clearly linked to crash risk, with crash risk significantly increasing with any detectable BAC in the driver’s physiological system (Phillips & Brewer, 2011).

Drinking drivers are commonly detected behind the wheel. To illustrate, in Queensland in the 2014 calendar year, 3,885,139 RBT identified 23,182 drinking drivers across the state, a hit rate of 1 per 167.6 tests. Within the Sunshine Coast region only – a popular holiday destination for domestic and international tourists alike – 300,645 RBT tests identified 1,768 drinking drivers, a hit rate of 1 per 170 tests (Queensland Police Service, 2015). It is notable, however, that RBT detects only those drivers, detained and tested at the roadside, during either fixed or mobile enforcement operations, and thus such hit-rates are indeed likely to be an underestimation. Such assertions are further reinforced by findings that deliberate avoidance of police and associated enforcement activities, including RBT, is commonly undertaken by Australian drivers (e.g., as self-reported by young novice drivers in

Note that these figures include estimations due to notable data limitations including data summarily unavailable (e.g., serious and other injury data in New South Wales), exclusion of vulnerable road users (e.g., pedestrians and cyclists in Queensland), and variation in the BAC criterion for alcohol-involved crashes (e.g., Northern Territory assuming a minimum BAC of .03 despite the national legal minimum BAC of .05).
Queensland, Scott-Parker et al., 2011). Perhaps unsurprisingly, then, drink driving is commonly reported by drivers themselves. A 2009 Australia-wide survey revealed that 58% of drivers had previously driven under the influence of alcohol, with 72% of these drivers admitting to driving after consuming alcohol at least twice in the previous year (Owens & Boorman, 2012). In a Queensland-wide self-report survey, 13.8% of young drivers aged 18-20 years (18.5% of males, 11.8% of females) with a Provisional (intermediate) driver’s licence reported they had driven while over the legal alcohol limit (it is noteworthy that these drivers must have a zero BAC) (Scott-Parker et al., 2014); while 12.4% of middle-age (40-55 years) and 3.1% of older (65-74 years) drivers involved in a fatal road crash in Australia during the period 1996-1999 exceeded the 0.05 BAC (Langford & Koppel, 2006). In Finland, the profile of a ‘typical drink driver’ during 1990-2008 was found to be male (5 times’ greater risk of driving under the influence than females), aged 40-49 years (Portman et al., 2013).

One of the most commonly reported reasons for driving after drinking is the perceived need or desire to get home/to a preferred destination (Alonso et al., 2015; Kulick & Rosenberg, 2000). Gustin and Simon (2008) found individuals are less likely to drive after drinking if they only have a short distance to drive, which may be related to a cheaper fare for alternative transport methods such as a taxi. The likelihood of detection or crash-involvement also influences the decision to drive after drinking (Gustin & Simon, 2008; Morris et al., 2014), and the perceived danger of driving after drinking is reduced on the descending limb of the BAC curve (i.e., when blood alcohol levels are declining; Morris et al., 2014).

Owen and Boorman (2012) reported that many Australians believed they would know if they were over the legal limit, with their judgment based on feelings. Research indicates that when individuals are objectively intoxicated but do not necessarily feel impaired/intoxicated, they are more likely to drive after drinking (Gustin & Simon, 2008).
Quinn and Fromme (2012), suggesting that ‘judgment based on feelings’ is problematic indeed. Binge drinkers, compared with non-binge drinkers, often report feeling less affected by alcohol (Brumback et al., 2007) and report having a greater ability to drive following alcohol consumption (Marczinski et al., 2008). In addition, whilst heavy drinkers have been found to consistently underestimate their BAC, moderate drinkers have been found to relatively accurately estimate their BAC after estimation training which combines education regarding alcohol intoxication and regarding internal intoxication cues (see Aston & Ligouri, 2013 for a review). Interestingly, simulator-based research which involved the administration of placebo or alcohol in social and non-social environs revealed that intoxication expectancy impacted on self-perceived intoxication: that is, drivers consuming a placebo in a social context overestimated their intoxication more often than drivers consuming a placebo alone (Charlton & Starkey, 2015).

Health promotion messages in Australia encourage the monitoring of the number of standard drinks consumed prior to driving, such that the patron is able to moderate their drinking to ensure their BAC does not exceed 0.05 (e.g., see www.alcohol.gov.au: one standard drink contains 10 grams of alcohol). The recommendation for males is to consume no more than two standard drinks in the first hour, and one standard drink each hour after that; for females, no more than one standard drink in the first hour, and one standard drink each hour after that (e.g., Australian Transport Safety Bureau, ATSB, 2005). Such health promotion messages may be problematic, as numerous physiological (e.g., medication, weight) and other factors (e.g., carbonated drinks) impact upon BAC. Given the plethora of drinking vessels available within Australia, ranging from glasses which hold the alcohol contained in a larger vessel to the stubbie in which the alcohol itself is held, accurately estimating the amount of alcohol within one ‘standard drink’ through this vessel is problematic. Such estimation is further complicated through the wide range of alcohol within
drinks of similar-sized vessels (e.g., 250mL bottles may contain beverages that range from
<8% alcohol to >14% alcohol). In addition, drivers find it difficult to accurately estimate
their BAC, with underestimation leading to the mistaken perception that their BAC is within
legal limits (e.g., see Beirness, 1987; Aston & Liguori, 2013). As such, restaurant patrons
may believe they will remain under the legal limit and therefore they may drive to the venue,
and drive home, whilst intoxicated. In addition, such health promotion campaigns do not
suitable target persons such as restaurant patrons who may change their mind – for whatever
reason, including the failure of a designated driver to stay sober – and drive home after
drinking, despite the decision at the beginning of the evening that they would drink and would
not drive. Such persons are unlikely to have kept count of the number of drinks they had
consumed, and indeed the accuracy of their count may be affected by the quantity of alcohol
which had been consumed during the evening. Such circumstances may also arise within the
unique environs of the popular destination of the Sunshine Coast, with entertainment and
dining within relatively close proximity to holiday accommodation and general suburbia.

**Study aim**

The pilot research aimed to investigate the commuting behaviour and BAC of diners
at Sunshine Coast restaurants. While the drinking behaviour of diners who had driven to, and
anticipated driving home from, the restaurant will be explored, the commuting behaviour and
BAC of diners more generally remains of interest given that these diners may change their
mind at the end of their evening, thus driving home from the restaurant.

**Method**

**Participants**

Five hundred and forty-four diners (n = 260 males) participated in the research
project, conducted during October 2014 (Australian spring).
Diners were approached as they sat in various Sunshine Coast restaurants\(^2\) and asked if they would like to participate in a brief interview in a convenience sampling methodology. The interview comprised an online survey populated by the interviewer, consisting of questions exploring commuter behaviour (e.g., *How did you arrive here tonight?*) and their BAC (e.g., *How do you know if you have reached the alcohol limit?*). Actual BAC readings were measured by a digital breathalyser device, with participants able to choose whether or not to use the device, and whether or not to disclose this reading to the researchers. All participants were offered a $5 taxi voucher or $5 bus fare to thank them for their time.

**Statistical analyses**

Comparison of frequencies was undertaken by Pearson’s chi square test; and comparison of means was undertaken by independent samples t-test and analysis of variance, with significance of \(p < .05\). Please note that for ‘estimate BAC’, Levene’s test was significant, thus equal variances cannot be assumed; and for ‘actual BAC’, Levene’s test was not significant, thus equal variances can be assumed. All data was exported from SurveyMonkey to the Statistical Package of the Social Sciences (SPSS) version 22.0.

**Results**

**Commuting behaviour**

Overall, as can be seen in Table 1, most participants reported driving or being driven by someone – most commonly their partner, a friend or family member – to their dining venue. For the journey home from the restaurant, the majority of participants again reported they would drive or be driven by someone. The proportion of participants walking remained relatively stable; however the proportion of participants catching a taxi/bus increased. A handful of participants did not know how they would journey home. As can also be seen in

\(^2\) Note that diners may have been at any point in their dining experience, including pre-order, during their dining/drinking, and before payment for their dining.
Table 1, there was a statistically significant association between gender and how participants arrived. A higher percentage of females were driven by another person, whereas a higher percentage of males drove or walked. In contrast, there was no significant difference in the return-home commute. Commuting behaviour by age was also examined (results not shown). Age was significantly associated with commuting behaviour for both arrival and departure. Younger drivers (<17-29 years) were more likely to be driven by someone than older drivers (>59 years). Drivers aged 40-49 years were most likely to report driving themselves (43.8%), with drivers aged 30-39 years least likely to report they planned to drive themselves home (22.1%). Drivers aged 30-39 years were the age most likely to catch a taxi/bus (17.2%), while drivers aged > 59 years were least likely to catch a taxi/bus (6.4%). More than half (53%) of participants >59 years walked to the venue and would walk home (51.1%); patrons aged 21-29 years were the least likely to walk to the venue; and patrons aged <17-20 and 40-49 were the least likely to walk home.

[insert Table 1 here]

**Blood alcohol concentration**

Overall, 95.5% of participants felt that it was very important to remain under the legal limit, with only a very small percentage of participants thinking it was either fairly important (1.9%) or not important at all (2.6%). A significantly greater percentage of females than males ($p < 0.01$) felt it very important to remain under the legal limit, while a higher percentage of males than females felt it fairly important. Interestingly, 4.2% of males felt it was not important at all. For drivers only, 5.1% of males, and no females, felt that remaining under the legal limit was not important (ns). Regarding participant age, 100% of participants aged >59 years felt it was very important to remain under the legal limit. Patrons aged 40-49 years were the least likely to report that it is very important to remain under the legal limit.
(95.8%) (ns). For drivers only, only one participant (aged 21-24 years) reported that it was not important to remain under the legal limit (ns).

Table 1 also summarises participants’ responses to ‘How do you know if you have reached the alcohol limit?’ and ‘How easy is it to estimate your BAC’. Overall, the majority of participants believed that they could determine when they reached the legal limit by counting the number of drinks, while only a small proportion of participants believed they could feel when they have reached the legal limit. A large proportion of participants reported not drinking and driving (suggesting that they do not monitor their alcohol intake), while a small proportion of participants reporting not knowing (suggesting again that they do not monitor their alcohol intake). For drivers only (not shown), 50.6% of participants reported counting drinks, 32.4% don’t drink and drive, and 5.2% reported feelings as the way to know they have reached the alcohol limit (the remainder didn’t know) (p<.05). Overall, a substantial proportion of participants believed it is hard or very hard to estimate their BAC. For drivers only (not shown), 37.8% of participants reported it was hard or very hard, and 40.4% reported it was easy or very easy, to estimate their BAC (p<.05).

There was a significant association between gender and knowing when they had reached the legal BAC limit, and between gender and how easy it is to estimate their BAC. While there was no significant difference between males and females for counting the number of drinks, more males than females believed they could feel when they had reached the legal limit. While most participants in total reported it was hard to estimate BAC, females appear to be less confident than males in their ability to estimate BAC, with over half of females thinking it hard/very hard, compared to 40% of males who thought it hard/very hard. For drivers only, males and females most commonly reported counting drinks (46.2% and 55.3% respectively) and not drinking (34.6%, 30.3%), with few drivers relying on their feelings (12.8%, 10.5%) (ns).
The association between age and how the participants know when they have reached the legal alcohol limit was also statistically significant ($p<.001$). Interestingly, a considerably higher proportion of <17-20 year olds reported not drinking and driving (67.2%, and it is noteworthy that in Australia, the minimum legal drinking age is 18 years), compared to every other age group. More than half of the participants between the ages of 21-24, 25-29, 40-49, and 50-59 years reported they knew when they’d reached the legal limit by counting the number of drinks. Compared to the other age groups, 30-39 years had the largest proportion (21-24 years the lowest) of participants reporting that they could feel/sense when they had reached the legal limit (8.0%, 3.2% respectively). For drivers only, abstaining from drinking was most commonly reported by participants aged <17-20 years (86.7%) and least commonly by participants aged 50-59 years (12.0%). Counting was most commonly reported by participants aged 50-59 years (72.0%) and least commonly by participants aged <17-20 years (0%) ($p<.001$, noting violation of chi-square cell size assumption). The relationship between age and ease of BAC estimation was not significant; however participants aged <17-20 years had the highest (52.9%), while > 59 years the lowest (46.7%), proportion of participants reporting it was hard/very hard to accurately estimate BAC. For drivers only, participants aged 30-39, 21-24, and 40-49 years (45.0%, 43.8% and 43.8% respectively) reported it was hard/very hard to accurately estimate BAC, while participants aged 25-29 years, >59 years, and 50-59 years reported it was easy/very easy to accurately estimate BAC (60.0%, 57.2%, and 52% respectively).

Table 1 also summarises the time since the last drink of an alcoholic beverage. For the majority of participants, the last drink was consumed < 15 minutes previously. There was no significant difference in time since the last drink for males and females, whilst there was a significant relationship between age and the time since last drink. Roughly half of participants in age groups 25-29, 30-39, and 50-59 years reported their last drink was <15
minutes previously. Overall, 178 participants had consumed no alcohol at all. Participants aged <17-20 years had the greatest proportion of participants consuming no alcohol at all, while participants aged 50-59 years had the smallest proportion of participants consuming no alcohol at all.

Table 2 summarises the estimated BAC and the actual BAC for all participants, and for males and females. It is noteworthy that more than half of males and females expected their BAC to be less, and there was a significant relationship between age and estimated BAC scores (results not shown), with post hoc analyses revealing that participants aged <17-20 years’ estimated BAC \( (M = .036, SD = .025) \) was significantly lower than participants aged 30-39 years \( (M = .051, SD = .067) \) and participants aged 50-59 \( (M = .050, SD = .054) \). Participants aged 30-39 years and 50-59 years estimated BAC was significantly higher than participants aged > 59 years \( (M = .023, SD = .026) \). While there was no significant difference between age and whether participants expected BAC was less or more than the actual BAC, a larger proportion of 40-49 year olds expected their BAC to be less (65.2%) and a larger proportion of 30-39 year olds expected their BAC to be more than their actual BAC.

[insert Table 2 here]

Figure 1 summarises the participants’ BAC difference, calculated by actual BAC - estimated BAC, such that a negative difference score reflects overestimation of BAC (e.g., actual BAC = 0.03, estimated BAC = 0.05, difference = -0.02) and a positive difference score reflects underestimation of BAC (e.g., actual BAC = 0.05, estimated BAC = 0.03, difference = +0.02). A total of 188 participants overestimated their BAC scores, and 155 participants underestimated their BAC scores (Figure 1a). One hundred and twenty-eight participants (27.1% of those who disclosed an actual BAC level) had a BAC difference of 0. Regarding these participants, 5 participants with a BAC difference of 0 had an actual BAC reading between .03 and .06, indicating they estimated correctly; the remaining 123 participants all
had an actual BAC reading of 0, suggesting they had not consumed any alcohol on the night and therefore knew they would have a BAC reading of 0. Specifically, the highest overestimation score was 0.8 (50-59 years, female); and the largest underestimation was -0.43 (30-39 years, female).

[insert Figure 1 here]

As can be seen in Figures 1b and 1c, relatively equal numbers of females and males overestimated and underestimated their BAC (note also that outliers exceeding a difference greater than +/- 0.15 were excluded). Regarding age, relatively equal proportions of <17-20 years reported under/overestimating their BAC, with some underestimations by considerably larger amounts (largest overestimation by -0.05, largest underestimation 0.08). Twice as many 21-24 year olds overestimated their BAC, with the underestimations generally by larger amounts (half of underestimations exceeded 0.03; one quarter of overestimations exceeded 0.03), and more 25-29 year olds and 30-39 years underestimated their BAC. In comparison, a larger proportion of participants aged 40-49 years and 50-59 years overestimated their BAC, whilst a larger proportion of drivers aged >59 years underestimated their BAC.

**BAC of persons who intended to drive home**

As noted in Table 1, a considerable proportion of participants (28.7%) intended to drive home from the venue. The estimated and actual BAC of 145 persons who intended to drive home were examined, revealing that in general, intended-drivers estimated their BAC to be higher \( (M = 0.019, SD = 0.46) \) than it actually was \( (M = 0.014, SD = 0.035) \), with drivers aged <17, 21-24, 40-49, and 50-59 years overestimating their BAC, drivers aged 30-39 years accurately estimating their BAC in general, and drivers aged 25-29 and >59 consistently overestimating their BAC. Further, 49 participants who intended to drive home had a BAC of 0.

**Alternative travel options**
Participants were informed of alternative travel options available to them, such as a taxi voucher or bus voucher to the value of $5. The majority of participants reported that if the service were available, they would use it (see Table 1). Chi square analyses showed a significant relationship between gender and whether participants would use the service if available, and between age and how influenced they were by the voucher: 100% of participants aged 30-39 years said they would use it, with participants aged >59 years least interested in the service compared to all other age groups. There was also a significant relationship between age and how participants would travel tonight, and age and how influenced participants were by the voucher. Participants aged <17-20 years appeared to be most influenced by the voucher, whereas participants aged >59 years were least influenced by the voucher.

**Discussion**

An exploration of the commuting behaviour of restaurant patrons at the Sunshine Coast, Queensland, revealed that one third of participants drove themselves to the venue, and planned to drive themselves home. One quarter of participants advised they would walk to, and walk from, the venue. Approximately 40% of the participants advised that they do not drink and drive, and as such they would be abstaining from alcohol on this occasion. Of the remaining participants, 75% participants advised that they monitored their BAC by counting the number of drinks and 10% advised that they estimate their BAC by how they feel. Half of the participants advised that it was hard/very hard to estimate their BAC, with one third advising that it was easy/very easy to estimate their BAC. Actual BACs were measured and disclosed by most participants, revealing that one third of participants underestimated their BAC despite the actual BAC being less than expected for approximately half of the participants. While, alarmingly, some participants who intended to drive home had an actual BAC in excess of 0.05, the drinking behaviour of restaurant diners per se is also of interest as
diners may change their mind during the evening visit and drive home from the drinking venue.

**Practical implications**

From a road safety perspective, it is essential that persons who intend to drive do not consume alcohol prior to their drive, and, if they intend to consume alcohol prior to driving, that alcohol is consumed with moderation. Pleasingly, the research which was undertaken with persons who are patrons of restaurants in a highly-popular tourist destination revealed that a large proportion of persons who believed (and practised) that if they are going to drink, they are not going to drive, and vice versa. This notion is reflected the finding that many participants had an actual, an estimated, and a difference BAC level of zero. However, over half of the participants reported that they use popular measures to monitor their drinks, such as counting their drinks (e.g., see ATSB, 2015) or gauging how they are feeling (e.g., Aston & Liguori, 2013). It is noteworthy also that a considerable proportion of participants underestimated their BAC, and this may be associated with such unreliable measures of monitoring BAC levels. These findings suggest that drivers who use counting and/or feelings as a way to monitor their BAC may not realise that these procedures are imprecise at best (counting), and disastrous at worst (feelings) (see also Beirness, 1987), thereby placing themselves and all others with whom they share their car and the road at increased risk of harm. While a multitude of intervention should (rightly) target ‘drinkers’, consideration of standards for supplying alcohol (such as a specific bottle shape for all alcoholic drinks of a particular concentration) or consuming alcohol (such as a specific glass shape for all alcoholic drinks of a particular concentration) could also assist ‘drinkers’ to follow widespread public health recommendations to ‘count drinks’.

Interventions including cost-effective interventions (Ditsuwan et al., 2013) such as general education should highlight the inaccuracy associated with these measures, and the
difficulty of accurately estimating a BAC, whilst promoting the safest option of ‘you drink, no drive’ (and, equally, ‘you drive, no drink’). Interestingly, the underestimation of BAC may reflect the ‘social’ circumstances of drinking, such as in a restaurant, that has been found to increase perceived BAC in addition to driving errors in excess of those driving in non-social circumstances (Charlton & Starkey, 2015), or it may reflect that these participants did not plan to drive home and therefore had not attempted to monitor their alcohol intake. Similar to driving, there are considerable road safety risks associated with drink-walking (Paulozzi, 2006). Therefore given that one quarter of the participants intended to walk home (after arriving via walking), the real road safety risks associated with drink walking should also be highlighted in general and targeted campaigns. Generalised enforcement of BAC levels (e.g., see Ditsuwan et al., 2013) should continue, particularly as drink driving continues to be identified as a contributor to risky driving such as speeding and not wearing seatbelts (e.g., Scott-Parker et al., 2014). Finally, it is noteworthy that the $5 taxi fare/bus ticket is unlikely to cover the cost of many trips from restaurants, given the complex and wide-ranging Sunshine Coast region and associated infrastructure. As such, not only may participating residents – rather than tourists – not have accepted or been interested in the proffered subsidy, it is unlikely such a small subsidy will achieve high-uptake as an intervention.

In addition, targeted intervention efforts appear warranted, particularly as some problematic groups of restaurant patrons were identified. For example, the largest proportion of participants advising that their BAC was more than expected were aged 30-39 years, followed by drivers aged >59 years; suggesting that education target persons who are likely to be experienced drinkers and experienced drivers (in comparison to the youngest participants, every one of which planned to drive home had a zero BAC). These findings are consistent with findings in the literature regarding older drivers (e.g., Langford & Koppel, 2006) and binge drinkers (e.g., Brumback et al., 2007; Marczinski et al., 2008). Interestingly
every female driver who stated they would be driving home had a legal BAC, suggesting that gender-specific interventions should target male drivers.

**Strengths and Limitations**

The research had a number of strengths, including the operationalisation of a brief survey regarding commuting behaviour to/from venues in a popular tourist destination, and exploration of estimated and actual BAC levels captured by a breathalyser device. The participant response rate was unable to be calculated, however, as the number of persons who refused to participate is not available, and given the nature of the data collection procedure, some restaurant patrons may have left the venue whilst the interviewer was engaged with other participants. The representativeness of the sample is unknown at this time, as baseline rates regarding the sociodemographic characteristics of persons who are patrons in restaurants on the Sunshine Coast is unknown. In addition, the actual commute behaviour to/from the venue was not able to be verified by objective measures such as observation, the actual BAC readings were not disclosed by a small number of participants, and the ‘dining stage’ (pre-meal, dining, pre-payment) at which the restaurant patrons was not recorded in this pilot project. In addition, the accuracy of the device which measure the breath alcohol remains unable to be determined at this time, therefore the actual BAC levels, as reported within this manuscript, are suggestive. While a number of future research directions are thus apparent, and these are more explicitly discussed below, it is noteworthy that this pilot project provided a vital opportunity to develop, refine, and strengthen the interdisciplinary research team, in addition to developing the team members’ research and collaboration capacities and capabilities for the betterment of future research endeavours. Much research is undertaken in a ‘silo’ fashion, with such multidisciplinary efforts long overdue and sorely needed for effective intervention in road safety more generally, and alcohol-related road safety specifically.
Future research

Future research could attempt to characterise the nature of restaurant patrons in popular tourist destinations (which may differ according to season and day of the week), and therefore select a stratified sample of participants who are representative of restaurant patrons, in addition to stratifying across the dining experience (pre/during/post meal). Comparing the experiences and knowledge of the patrons who intended to drive home to that of the patrons who did not intend to drive home in greater depth could also provide important insight for intervention, as could an exploration of the dining behaviours (e.g., what food was consumed and when, in relation to alcohol consumption) and usual drinking behaviours (such as the amount of alcohol consumed and the regularity of consumption) of the restaurant patrons. Drinking patterns in particular could reveal vulnerable groups which require specialised intervention, and could similarly reveal groups that are experienced in estimating and/or monitoring their BAC. Such information could be augmented by reasons for non-participation (which is unable to be calculated at this time), and non-disclosure of actual BAC readings (notwithstanding this occurred for only a small portion of participants), and additional information regarding the data collection logistics (such as the type and number of participating restaurants, day of week, time of day, period of the lapse between most recent alcohol consumption and breath alcohol measurement).

The participants could be observed leaving/arriving at the restaurant venues to dis/confirm their commuter behaviour. Further details regarding the participants may be of interest, such as whether the person is a local resident (and therefore in general they may be more likely to have their own vehicle as a mode of transport) or a tourist (and therefore more likely to be reliant on paid methods of transport or walking to/from the venue) to elucidate the commute behaviour and BAC of tourists and residents. Examination of the drinking glass, particularly the size and the type of alcohol consumed, in addition to investigating how many
standard drinks’ the participant believed was held in their drinking glass through means such as flash cards featuring a range of drinking glasses, could further inform drink driving intervention and reinforce the recommendation of separating drinking behaviour and driving behaviour (and walking behaviour, given the increasingly-common circumstance, and relatively unexplored phenomenon, of drink-walking). Future endeavours could also explore the merit, utility, and efficacy of restaurant patrons being able to access a reliable, cost-effective measure of their BAC prior to departing from such venues as an alternative to the problematic approaches of counting drinks and assessing feelings, particularly in popular tourist destinations such as the Sunshine Coast. Given the potentially very high costs of traversing the broad Sunshine Coast via paid fares (e.g., taxis), future research should also explore the utility and efficacy of alternative transportation options, consistent with recent applications of systems thinking in road safety (e.g., Scott-Parker et al., 2015, 2016).

**Conclusions**

The road safety risks associated with drink driving have been well recognised in the road safety literature for decades. Despite this knowledge, and despite widespread education and enforcement efforts, alcohol continues to contribute to road crash injuries and fatalities around the world. Australian health promotion messages advise commuters to count the number of drinks they consume so that they may remain under the BAC limit when they participate in social events to and from which they commute; however the commuting behaviour and estimated and actual BAC levels of persons who are restaurant patrons in the popular Sunshine Coast region was unknown. The commuting behaviour of a convenience sample of 544 diners revealed that a large proportion of drivers drove themselves to, and intended to drive home from, the restaurant; most participants estimated their BAC by counting the number of drinks or gauging how they are feeling; and that a third of participants believed that it was easy/very easy to estimate their BAC. The actual BAC was
more than expected for a third of participants, however, suggesting that BAC estimation may not be as easy, or as reliable, as many persons believe, and despite as suggested in health promotion message. Intervention efforts should emphasise the difficulty in estimating BAC, and encourage abstention from drinking (if planning to drive) or driving (if planning to drink) despite public health messages encouraging counting drinks. In addition, public health and traffic injury prevention messages should highlight the increasingly-recognised risks associated with drink-walking, given that a notable one-quarter of participants planned to walk home from the restaurant venue.

Acknowledgements

The first author is supported by a National Health and Medical Research Council Research Fellowship.
References


Australian Transport Safety Bureau. (ATSB). (2005). *Do you know when to stop? A driver’s guide to staying under 0.05 BAC.* Department of Transport and Regional Service: Canberra.


Phillips, D. P., & Brewer, K. M. (2011). The relationship between serious injury and blood alcohol concentration (BAC) in fatal motor vehicle accidents: BAC= 0.01% is associated with significantly more dangerous accidents than BAC= 0.00%. *Addiction, 106*(9), 1614-1622.


Figures

Figure 1a BAC difference scores for ALL participants \((n = 462)\)  
(Note: missing data \(n = 73\), Outliers +/- 0.15, \(n = 9\)).

Figure 1b BAC difference scores for male participants \((n = 229)\)  
(Note: missing data \(n = 27\), Outliers +/- 0.15, \(n = 4\)).
Figure 1c BAC difference scores for female participants ($n = 233$) (Note: missing data $n = 46$, outliers +/- 0.15, $n = 5$).
### Tables

#### Table 1

**Summary of Responses Regarding Commuting Behaviour and Blood Alcohol Concentration, by Gender**

<table>
<thead>
<tr>
<th>Survey item</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$N = 544$</td>
<td>$N = 260$</td>
<td>$N = 284$</td>
<td>$p$</td>
</tr>
<tr>
<td></td>
<td>$N$</td>
<td>%</td>
<td>$N$</td>
<td>%</td>
</tr>
</tbody>
</table>

**Commuting behaviour**

How did you arrive tonight?

- **Driven by other**
  - Total: 164 (30.1%)
  - Male: 56 (21.5%)
  - Female: 108 (38.0%)

- **Drove**
  - Total: 180 (33.1%)
  - Male: 96 (36.9%)
  - Female: 84 (29.6%)

- **Taxi/Bus**
  - Total: 64 (11.8%)
  - Male: 32 (12.3%)
  - Female: 32 (11.3%)

- **Walked**
  - Total: 136 (25.0%)
  - Male: 76 (29.2%)
  - Female: 60 (21.1%)

  <.001

When you leave, how will you travel?

- **Driven by other**
  - Total: 135 (24.8%)
  - Male: 56 (21.5%)
  - Female: 79 (27.8%)

- **Drive**
  - Total: 156 (28.7%)
  - Male: 79 (30.4%)
  - Female: 77 (27.1%)

- **Taxi/Bus**
  - Total: 107 (19.7%)
  - Male: 47 (18.1%)
  - Female: 60 (21.1%)

- **Walk**
  - Total: 141 (25.9%)
  - Male: 76 (29.2%)
  - Female: 65 (22.9%)

- **Don’t know**
  - Total: 5 (0.9%)
  - Male: 2 (0.8%)
  - Female: 3 (1.1%)

  $p = .237$

**Blood Alcohol Concentration**

How do you know if you have reached the legal alcohol limit?*

- **Don’t drink drive**
  - Total: 215 (39.7%)
  - Male: 88 (34.1%)
  - Female: 127 (44.9%)

- **Count**
  - Total: 250 (46.2%)
  - Male: 119 (46.1%)
  - Female: 131 (46.3%)

- **Feelings**
  - Total: 30 (5.5%)
  - Male: 20 (7.8%)
  - Female: 10 (3.5%)
How easy is it to estimate your BAC?

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Counts</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very hard</td>
<td>107</td>
<td>19.7%</td>
</tr>
<tr>
<td>Hard</td>
<td>149</td>
<td>27.4%</td>
</tr>
<tr>
<td>Average/Refused</td>
<td>88</td>
<td>16.2%</td>
</tr>
<tr>
<td>Easy</td>
<td>137</td>
<td>25.2%</td>
</tr>
<tr>
<td>Very easy</td>
<td>63</td>
<td>11.6%</td>
</tr>
</tbody>
</table>

* Three participants refused and were not included in analyses.

BAC = Blood Alcohol Concentration.

Count = Count the number of drinks.
Table 2

*Blood Alcohol Concentrations (Estimates, Actual Readings, and Expectations regarding the difference between actual and estimated BACs), Total and by Gender*

<table>
<thead>
<tr>
<th>Survey item</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Estimated BAC</td>
<td>540</td>
<td>100.0%</td>
<td>.038</td>
<td>.043</td>
</tr>
<tr>
<td>Actual BAC</td>
<td>529</td>
<td>97.2%</td>
<td>.046</td>
<td>.064</td>
</tr>
<tr>
<td>Actual BAC more or less than expected</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More</td>
<td>117</td>
<td>43.7%</td>
<td>55</td>
<td>44.4%</td>
</tr>
<tr>
<td>Less</td>
<td>151</td>
<td>56.3%</td>
<td>69</td>
<td>55.6%</td>
</tr>
</tbody>
</table>

Estimated BAC: males $N = 260$, females $N = 284$
Actual BAC: males $N = 254$, females $N = 275$
Note that for 276 participants, the actual BAC was the same as the expected BAC. This group includes participants who did not drink alcohol (and therefore their estimate of zero would be correct) and participants who did drink alcohol (and therefore their estimate was correct).
Missing participants refused to use the Breathalyser device, or refused to disclose the Breathalyser reading.
**Appendix**

### Summary of Responses Regarding Commuting Behaviour and Blood Alcohol Concentration, by Gender

<table>
<thead>
<tr>
<th>Survey item</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 544</td>
<td></td>
<td>N = 260</td>
<td>N = 284</td>
<td>p</td>
</tr>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
</tbody>
</table>

#### Commuting behaviour

**How did you arrive tonight?**

<table>
<thead>
<tr>
<th>Method</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driven by</td>
<td>164</td>
<td>56</td>
<td>108</td>
<td>38.0%</td>
</tr>
<tr>
<td>Drove</td>
<td>180</td>
<td>96</td>
<td>84</td>
<td>29.6%</td>
</tr>
<tr>
<td>Taxi/Bus</td>
<td>64</td>
<td>32</td>
<td>32</td>
<td>11.3%</td>
</tr>
<tr>
<td>Walked</td>
<td>136</td>
<td>76</td>
<td>60</td>
<td>21.1%</td>
</tr>
</tbody>
</table>

**Driven by**

<table>
<thead>
<tr>
<th>Method</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner</td>
<td>48</td>
<td>13</td>
<td>35</td>
<td>32.4%</td>
</tr>
<tr>
<td>Other*</td>
<td>114</td>
<td>42</td>
<td>72</td>
<td>66.7%</td>
</tr>
<tr>
<td>Paid</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

**When you leave, how will you travel?**

<table>
<thead>
<tr>
<th>Method</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driven by</td>
<td>135</td>
<td>56</td>
<td>79</td>
<td>27.8%</td>
</tr>
<tr>
<td>Drive</td>
<td>156</td>
<td>79</td>
<td>77</td>
<td>27.1%</td>
</tr>
<tr>
<td>Taxi/Bus</td>
<td>107</td>
<td>47</td>
<td>60</td>
<td>21.1%</td>
</tr>
<tr>
<td>Walk</td>
<td>141</td>
<td>76</td>
<td>65</td>
<td>22.9%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

**Driven by**

<table>
<thead>
<tr>
<th>Method</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner</td>
<td>42</td>
<td>19</td>
<td>23</td>
<td>29.1%</td>
</tr>
<tr>
<td>Other*</td>
<td>92</td>
<td>36</td>
<td>56</td>
<td>70.9%</td>
</tr>
<tr>
<td>Paid</td>
<td>1</td>
<td>1</td>
<td>_</td>
<td>_</td>
</tr>
</tbody>
</table>

**If this service was available, would you use it?**

<table>
<thead>
<tr>
<th>Response</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>484</td>
<td>223</td>
<td>261</td>
<td>91.9%</td>
</tr>
<tr>
<td>No</td>
<td>36</td>
<td>27</td>
<td>23</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

**How will you travel home tonight?**

<table>
<thead>
<tr>
<th>Method</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driven by</td>
<td>136</td>
<td>55</td>
<td>81</td>
<td>28.6%</td>
</tr>
<tr>
<td>Drive</td>
<td>152</td>
<td>73</td>
<td>79</td>
<td>27.9%</td>
</tr>
<tr>
<td>Mode</td>
<td>Count</td>
<td>Percentage</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>Taxi/Bus</td>
<td>101</td>
<td>18.8%</td>
<td>48</td>
<td>18.9%</td>
</tr>
<tr>
<td>Walk</td>
<td>142</td>
<td>26.4%</td>
<td>75</td>
<td>29.5%</td>
</tr>
<tr>
<td>Other**</td>
<td>6</td>
<td>1.1%</td>
<td>3</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

Was your decision influenced by the voucher?

<table>
<thead>
<tr>
<th>Influence</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot</td>
<td>157</td>
<td>28.9%</td>
<td>73</td>
<td>28.2%</td>
<td>84</td>
<td>29.6%</td>
</tr>
<tr>
<td>A little</td>
<td>83</td>
<td>15.3%</td>
<td>39</td>
<td>15.1%</td>
<td>44</td>
<td>15.5%</td>
</tr>
<tr>
<td>Not at all</td>
<td>303</td>
<td>55.8%</td>
<td>147</td>
<td>56.8%</td>
<td>156</td>
<td>54.9%</td>
</tr>
</tbody>
</table>

**Blood Alcohol Concentration**

How do you know if you have reached the legal alcohol limit?

<table>
<thead>
<tr>
<th>Method</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t drink drive</td>
<td>215</td>
<td>39.7%</td>
<td>88</td>
<td>34.1%</td>
<td>127</td>
<td>44.9%</td>
</tr>
<tr>
<td>Count</td>
<td>250</td>
<td>46.2%</td>
<td>119</td>
<td>46.1%</td>
<td>131</td>
<td>46.3%</td>
</tr>
<tr>
<td>Feelings</td>
<td>30</td>
<td>5.5%</td>
<td>20</td>
<td>7.8%</td>
<td>10</td>
<td>3.5%</td>
</tr>
<tr>
<td>I don’t know</td>
<td>46</td>
<td>8.5%</td>
<td>31</td>
<td>12.0%</td>
<td>15</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

How easy is it to estimate your BAC?

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very hard</td>
<td>107</td>
<td>19.7%</td>
<td>43</td>
<td>16.5%</td>
<td>64</td>
<td>22.5%</td>
</tr>
<tr>
<td>Hard</td>
<td>149</td>
<td>27.4%</td>
<td>60</td>
<td>23.1%</td>
<td>89</td>
<td>31.3%</td>
</tr>
<tr>
<td>Average/Refused</td>
<td>88</td>
<td>16.2%</td>
<td>51</td>
<td>19.6%</td>
<td>37</td>
<td>13.0%</td>
</tr>
<tr>
<td>Easy</td>
<td>137</td>
<td>25.2%</td>
<td>70</td>
<td>26.9%</td>
<td>67</td>
<td>23.6%</td>
</tr>
<tr>
<td>Very easy</td>
<td>63</td>
<td>11.6%</td>
<td>36</td>
<td>13.8%</td>
<td>27</td>
<td>9.5%</td>
</tr>
</tbody>
</table>

How long since your last drink?

<table>
<thead>
<tr>
<th>Time</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;15 min ago</td>
<td>244</td>
<td>44.9%</td>
<td>119</td>
<td>45.8%</td>
<td>125</td>
<td>44.0%</td>
</tr>
<tr>
<td>&gt;15 min ago</td>
<td>198</td>
<td>36.4%</td>
<td>91</td>
<td>35.0%</td>
<td>107</td>
<td>37.7%</td>
</tr>
<tr>
<td>No alcohol tonight</td>
<td>102</td>
<td>18.8%</td>
<td>50</td>
<td>19.2%</td>
<td>52</td>
<td>18.3%</td>
</tr>
</tbody>
</table>

* Other includes “friends/family”. Partner includes “wife/husband/girlfriend/boyfriend”

** Other includes staying in hotel, no breath test, friend

‘How know if reached alcohol limit’ 3 participants refused and were not included in analyses.

BAC = Blood Alcohol Concentration.

Count = Count the number of drinks.

_ = Not Applicable