

**Drinking to excess and the tipping point: An international study of alcohol intoxication
in 61,000 people**

TITLE PAGE

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ABSTRACT

Background: People who drink alcohol often seek to manage their intake in order to maximise the pleasurable effects, such as feelings of sociability and relaxation, without reaching their ‘tipping point’, where they feel out of control, or unwell. This paper aimed to explore three stages of intoxication; feeling the effects; being as drunk as you would like to be; and reaching the tipping point (feeling more drunk than you want to be) in a large international sample.

Methods: The Global Drug Survey (GDS) is an annual, cross-sectional, online survey of drug use. This paper draws on data from 61,043 respondents (63.7% male) from 21 countries who took part in GDS2015 collected in November 2014 to January 2015. Respondents reported their usual type of drink; how many drinks they would require to reach each stage of intoxication and how frequently they reached each stage. Alongside socio-demographic measures, they also completed the Alcohol Use Disorders Identification Test (AUDIT).

Results: Male respondents reported consuming 87.55gm to be as drunk as they want to be and female respondents reported 70.16gm, on average. The tipping point was reached at 138.65gm for male respondents and 106.54 gm for female respondents. Overall 20.3% reported reaching their tipping point at least once a month. Being male, aged under 25 and at higher risk for alcohol use disorder was associated with reporting reaching the tipping point more frequently.

Conclusions: The amount of alcohol being consumed to reach a desired point of intoxication is much higher than the maximum daily, and sometimes weekly, amount recommended by country guidelines. Encouraging people to avoid reaching their tipping point may be a useful intervention point alongside better communication of low risk drinking guidelines.

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INTRODUCTION

In 2016, alcohol consumption contributed to 2.8 million deaths worldwide (GBD 2016 Alcohol Collaborators, 2018) and has been identified as a cause of seven types of cancer (Connor, 2016). Levels of alcohol consumption are increasing across the world, with this trend being driven by rises in South-East Asia and Western Pacific countries (WHO, 2018). Such a rise will lead to an increase in the burden of alcohol related harms, with liver disease a particular concern in lower resource countries (Mehta & Sheron, 2019). Excessive alcohol consumption also impacts people who are close to that person, increasing the likelihood of experiencing stress, sexual abuse and violence (e.g. Enser, Appleton, & Foxcroft, 2017; Ferris, Devaney, Davis, & Mazerolle, 2016; Laslett et al., 2010) as well as placing a considerable economic burden on societies (WHO, 2018).

To guide both consumers and health professionals to help reduce excessive consumption, many countries have developed low risk drinking guidelines. In addition to variations in the number of grams per standard drink or unit, these guidelines also vary in their precise limits (Furtwaengler & de Visser, 2013; Kalinowski & Humphreys, 2016). However, common themes include advice on daily and on total weekly consumption and non-drinking days. Some countries have proposed different advice for men and women, while others have not; in Switzerland, men are advised to drink no more than two standard drinks per day and women no more than one (Swiss Federal Commission on Alcohol Issues, 2018), whereas men and women in the UK are both advised that low risk drinking constitutes no more than 14 standard drinks (or units) per week (Department of Health, 2016). The amount of alcohol in a standard drink also varies widely between countries, from 8gm in the UK to 19.6gm in Japan, with a modal value of 10gm (Furtwaengler & de Visser, 2013; WHO, 2018). The World Health Organisation

(WHO) definition of Heavy Episodic Drinking (HED) or 'binge' drinking, which is usually described as excessive consumption over a short period with the intention of getting drunk, is 60gm of alcohol in one session (WHO, 2018).

While the limits outlined in national guidelines are grounded in epidemiological research, their relevance people who drink alcohol may be limited. Drinking beyond these guidelines with the goal of relaxing, socialising and getting drunk is common (Babor et al., 2010; Hughes, Quigg, Ford, & Bellis, 2019; Measham, 2004; Peele & Brodsky, 2000; WHO, 2018). Indeed, many people who drink do so with the intention of feeling the effects along a spectrum of intoxication, often seeking to reach the 'right' level of consumption for that occasion (Lovatt et al., 2015), rather than aiming to drink within guidelines. This level or stage of consumption has been described in various ways: 'being in the zone' (Lyons, Emslie, & Hunt, 2014); 'staying in the sweet spot' (Graber et al., 2016); the 'ideal state' (Zajdow & MacLean, 2014); 'acceptable level of intoxication' (Aresi & Pedersen, 2016). Identifying the acceptable level of alcohol consumption is based on personal experience over time, learned through trial and error (Burgess, Cooke, & Davies, 2019). Recent research suggests social norms about the general level of drunkenness among others is distorted and that many people often exceed their desired level of intoxication (Hughes et al., 2019).

The desired point of intoxication may also vary between and within people depending on the situation. While most people want to stay 'in the zone' where they experience the most pleasure (as intoxicated as they wish to be), occasionally their consumption increases beyond this point and they reach their 'tipping point', where the experience is no longer pleasurable, and they feel out of control. This level of consumption has been variously described as 'the point of no return' (Lyons et al., 2014) or the 'danger zone' (Zajdow & MacLean, 2014). Previous research illustrates how people who drink try to strike a balance between having fun and being 'too drunk' (Beccaria, Petrilli, & Rolando, 2015; Graber et al., 2016). In a study in the UK (Burgess et al., 2019), some people who were asked to describe their experiences of approaching their

tipping point described it as totally positive, relaxing and pleasurable, whereas others experienced it as entirely negative, combined with nausea and anxiety. Once this tipping point was exceeded however, both groups described their experience in wholly negative terms, as anxiety producing, physically unpleasant and representing a complete loss of control (Burgess et al., 2019). Despite these findings, there is a lack of research on how much alcohol is consumed to reach different stages of intoxication, and how frequently people reach their tipping point.

The aim of this paper was to use data from a large-scale online survey of people who consume alcohol and other psychoactive substances (the Global Drug Survey) to define three different stages of alcohol intoxication: 1) feeling the effects of alcohol, 2) becoming as drunk as you would like to be, and 3) reaching the tipping point. Beyond identifying the volume of alcohol (in grams) needed to reach each stage of intoxication, we explored the frequency of reaching each stage of intoxication by socio-demographic characteristics and Alcohol Use Disorder Identification Test (AUDIT) scores. Finally, we analysed the data to identify variables associated with reaching each stage of intoxication at least monthly.

METHODS

Design and procedure

Using an encrypted online platform the Global Drug Survey (GDS) is an annual, anonymous cross-sectional survey developed to monitor trends in alcohol and other drug use and related harms. GDS2015 took place between November 2014 to January 2015¹, collecting data in 174 countries and 11 languages (English, German, Greek, Polish, French, Italian, Spanish, Portuguese, Flemish, Hungarian and Danish). GDS recruits an opportunistic sample of people who use or have used alcohol and/or other drugs worldwide via various media partners and harm reduction organizations. This means that the sample cannot be considered to be

¹ In most years the survey closes to new participants on Dec 30th, but people who have saved and returned can complete it for a couple more weeks.

representative of the populations within each included country in the study. However, analysis has demonstrated that GDS is able to recruit similar samples of people who use cannabis and alcohol regarding age and gender when compared to general household surveys in Australia, the United States and Switzerland (Barratt et al., 2017). A detailed breakdown of the recruitment and sampling strategy is available elsewhere (Barratt et al., 2017). Ethical approval was obtained from the Kings College London Research Ethics Committee 11671/001: Global Drug Survey, University of Queensland (No: 2017001452) and The University of New South Wales (HREC HC17769) Research Ethics Committees.

Participants

In total, 97,855 respondents from 174 countries took part in GDS2015. The current study draws on data from female and male respondents aged 16 to 80 years who indicated drinking alcohol at least once in the past year and resided in countries where over 200 respondents provided data about their drinking habits. People identifying as non-binary gender identity were not included in the current analysis because the numbers were too small for meaningful comparison analyses across gender. In total, data from 62,547 respondents who completed the questions about their usual drink size and levels of intoxication were considered for this study.

Measures

The Alcohol Use Disorders Identification Test (AUDIT; Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) is a 10 item questionnaire to assess alcohol consumption and harms. The scale ranges from 0-40 and is categorised as lower risk consumption (0-7), increasing risk (8-15), higher risk (16-19) and possible alcohol dependence (20+).

Type of alcohol consumed: Respondents were presented with a series of pictures depicting types of alcoholic beverages and a description of the amount of alcohol this contained (See Appendix A). This included four categories: wine; beer, cider or lager; spirits and alcopop/coolers (i.e. pre-

mixed single container). They were asked to select the type of alcohol that they consumed most often, and which size was a typical drink for them (sizes presented were as follows; wine = small wine 125ml, medium wine 175ml, large wine 200ml or other; beer/cider / lager = small 300ml, medium 400ml, large 500ml / other; spirit = small 30ml, large 60ml or other; alcopops = small 350ml large 700ml or other). We applied alcohol by volume (ABV) to each drink size using average estimates (IARD, 2019) for each product (wine = 12%, beer = 4.5%, spirits = 40% and alcopops = 5%) and then converted this volume into mass representing 10 grams of alcohol per 100 millilitres of the beverage. We used 10 grams as this is the World Health Organisation 'standard drink' estimate and the modal global value (WHO, 2018).

Reaching different stages of intoxication: After the pictures of beverages, respondents were presented with the following text:

"Imagine you were drinking just this type of drink and not using any other drugs. How many drinks would it take for you to reach the following stages of intoxication?"

The three stages were 'you can feel the effects', being 'as drunk as you would like to be' and 'the tipping point – starting to feel more drunk than you want to be'. Following the question about usual drink type, they were asked:

"Over the last 12 months, how often have you reached these stages of intoxication?"

Response options were 'at least weekly', 'at least monthly', 'at least once a year', 'less than once a year' and 'never'.

GDS2015 also contained a range of demographic measures including gender, age, and country of residence.

Analysis

Respondents who selected 'other' (N= 1,504) as their usual drink size were excluded from the analyses as the free text responses did not allow a meaningful volume of alcohol to be extracted. Chi squared tests revealed that there were significant associations between this group and those who did not select 'other' in terms of age, gender and AUDIT score, but the effect sizes observed were weak. ²

To compare frequency of reaching each stage we combined 'at least weekly' and at least monthly into one category (often), and 'at least once a year', 'less than once a year' and 'never' into another category (rarely/never). This decision was taken based on the WHO definition of heavy excessive drinking (HED), which is more than 60gm of alcohol at least once in the last 30 days (WHO, 2018). In particular, this is useful when looking at being 'as drunk as you would like to be' and the 'tipping point'. This level of drinking is associated with increased risk of acute consequences from alcohol.

Descriptive statistics were used to compare countries on socio-demographics, AUDIT scores, mean number of grams to reach each stage of intoxication and the frequency of reaching each stage. Mean grams for each stage of intoxication were compared between respondents from different countries using bar charts. Although grams were not normally distributed due to the large sample size, T-tests and ANOVAs were used (Fagerland, 2012) to explore differences between age, gender, and AUDIT score, and grams of alcohol consumed in each stage of intoxication, regardless of country of residence. Chi squared tests were then used to explore bivariate relationships between socio-demographics, AUDIT scores, and the frequency of reaching each stage of intoxication regardless of country of residence. Finally, multi-level logistic regression models were used to explore factors associated with reaching each stage of intoxication either weekly or monthly compared to yearly/less than yearly and never. These analyses involved clustering for country of residence to account for confounders relating to

² Age; $\chi^2(1) = 15.32, p < .001, V = .016$, gender ; $\chi^2(1) = 5.00, p = .025, V = .009$, AUDIT; $\chi^2(3) = 167.48, p < .001, V = .052$,

country that were not incorporated into the model, such as drinking culture. Thus the mixed models function in SPSS was used and country was entered in the models as a random factor, and the co-variables of sex, AUDIT score and age were entered as fixed factors. Analyses were conducted in SPSS 26 (IBM).

RESULTS

Descriptive statistics

The final sample included 61,043 respondents from 21 countries (Australia, Austria, Belgium, Brazil, Canada, Germany, Denmark, Spain, France, Greece, Hungary, Republic of Ireland, Italy, Netherlands, New Zealand, Poland, Portugal, Sweden, Switzerland, United Kingdom, United States; see Table 1). It should be noted that these 21 countries are from three regions (the Americas, Europe and, Western Pacific) identified in the WHO (2018) report where a majority of the population is currently consuming alcohol. Table 1 shows the demographic characteristics of the final sample of 61,043 respondents (63.7% male; mean age = 27.69). Median AUDIT score in the sample was 8 (interquartile range [IQR]: 5-12) and this varied between countries from 11 (IQR: 8-16) in the Republic of Ireland to 6 in Portugal (IQR: 4-9). Of the whole sample, 45.2% scored 0-7 on AUDIT and were categorised as low risk drinkers, 41.6% scored 8-15 and categorised as increasing risk, 7.8% scored 16-19 and categorised as higher risk and 5.4 scored 20+, therefore in the possible dependence category. There were high proportions of respondents from the Republic of Ireland (IE) and the Netherlands (NL) who were at increased risk (8-15; IE =47.80%; NL= 50.20%) or high risk (16+ ; IE=15.5%; NL=10.7) for alcohol use disorder. Eighty-five percent of the sample reported feeling the effects of alcohol at least monthly, 65.6% reported becoming as drunk as they would like to be at least monthly, and 20.3% reported reaching their tipping point at least monthly. Across all countries, about 50% reported feeling the effects from alcohol at least monthly. Over 25% of respondents from the Republic of Ireland, Brazil and Austria reached the tipping point at least monthly. The highest

frequencies for getting as drunk as they would like to be were noted in respondents from the Republic of Ireland (78.3%), France (71.3%), Austria (71.3%), Brazil (67.6%), Germany (68.8%) and the UK (67.1%) with over 2/3 of respondents from these countries reporting reaching this point at least monthly.

[Insert Table 1]

Comparing the number of grams of alcohol needed to reach each stage of intoxication between respondents from different countries with guidelines for low risk alcohol consumption

Figures 1-3 compare the grams of alcohol needed to reach each stage of intoxication by respondents' gender and country. Respondents from Denmark and the Netherlands needed comparatively higher average grams of alcohol to reach each stage of intoxication; by contrast respondents from Germany and Austria needed comparatively lower average grams of alcohol to reach each stage of intoxication. Respondents from the Republic of Ireland had the highest median AUDIT score (see Table 1), and were one of the top three in terms of the number of grams reported to reach the tipping point (Figure 3). Respondents from Portugal, who had the lowest median AUDIT score and the largest percentage of people in the low risk AUDIT category, reported consuming a comparatively higher amount of alcohol to reach each stage of intoxication.

[Insert Figures 1-3]

The amount of alcohol consumed to be as drunk as they want to be exceeded the daily maximum recommended intake by a factor of at least two (Table 2). For example, in Austria, the daily guidelines for women are 16 grams of alcohol, but on average respondents reported consuming 51.7 grams to be as drunk as they want to be (3.3 times the guidelines). Male respondents reported consuming 69.99 grams to be as drunk as they want to be compared to the 24 grams maximum recommended (3.05 times the guidelines). To reach the tipping point, some

respondents, reported drinking more than the *weekly* amount recommended by their country guidelines within a single session. For example in the UK, the average grams of alcohol to reach the tipping point for males (144.13gm) is 32gm more than the 112gm recommended weekly maximum.

[Insert Table 2]

Comparing alcohol grams needed to reach each stage of intoxication by gender, age and AUDIT categories – regardless of country of residence

In Table 3, the average grams of alcohol needed to reach each stage of intoxication is compared by demographic characteristics and AUDIT category. Male respondents reported they consumed significantly more alcohol than females to reach each stage. Furthermore, male respondents consumed about 3.6 times more alcohol to reach the tipping point than to feel the effects whereas female respondents needed 3.2 times more. Respondents in higher AUDIT categories reported consuming more to reach each stage of intoxication. Respondents younger than 25 years reported consuming higher amounts to reach each stage when compared to those 25 years and older. When looking at age as a continuous measure, Pearson correlations confirmed this relationship. There were weak significant negative correlations between age and alcohol grams for feeling the effects ($r = -.123, p < .001$), getting as drunk as you would like to be ($r = -.152, p < .001$) and reaching the tipping point ($r_s = -.162, p < .001$).

[Insert Table 3]

Chi squared tests comparing the frequency of reaching each stage of intoxication.

After it was established that respondents drank in excess of 60gm to be as drunk as they want to be and to reach their tipping point, it was deemed pertinent to explore what factors were linked to people feeling the effects and reaching the tipping point at least on a monthly basis, as they would be at increased risk of acute harms, and thus should be the target for interventions. Thus,

we combined 'at least weekly' and at least monthly into one category (often), and 'at least once a year', 'less than once a year' and 'never' into another category (rarely/never). The frequency of reaching each stage of intoxication often vs rarely/never for demographic characteristics and AUDIT category are reported in Table 4 and χ^2 were used to compare the frequencies without accounting for country of residence. Respondents who identified as male and those under 25 years were more likely to reach each stage at least monthly. Those in higher AUDIT categories were more likely to report reaching each stage of intoxication at least monthly.

[Insert Table 4]

Factors associated with frequency of reaching each stage of intoxication

Models are presented in Table 5. Each model compares the likelihood of being in the at least weekly and at least monthly category (often), compared to the 'at least once a year', 'less than once a year' and 'never' category (rarely/never). For the frequency of feeling the effects, being male, being younger, being in the upper three AUDIT categories compared to the low risk category were all associated with reaching this stage of intoxication at least monthly. Being as drunk as you want to be at least monthly was associated with being male, being younger, being in the upper three AUDIT categories compared to the low risk category. Reaching the tipping point was associated with being younger, and higher AUDIT categories. Drinking and feeling no effects was also associated with being younger and in higher AUDIT categories.

[Insert Table 5]

DISCUSSION

This paper investigated the amount of alcohol needed to reach three different stages of intoxication and the frequency of reaching these in a large, international, sample of people who drink alcohol. The major finding was that the amount of alcohol typically consumed to reach what respondents considered their optimal level of intoxication (as drunk as they want to be)

was almost double the upper limit recommended by governments/health organisations in most countries - at 87.55gm for men and 70.16gm for women - compared to a maximum of 40gm recommend by some countries and significantly higher than the 60gm defined as HED by the WHO (WHO, 2018). Even the amounts reported to feel the effect of alcohol approached the WHO HED level in some cases. The amount of alcohol required to reach the tipping point often exceeded the weekly maximum provided by the respective country guidelines. That the difference between these two levels was in the region of 30gm for women and 50gm for men suggests that there is an opportunity for interventions that discuss ideal and tipping point consumption. Drinking guidelines may need to provide more than just low risk drinking limits to include relevant advice for people enjoy drinking at potentially risky levels.

Exploring the role of educational interventions that encourage people with heavy drinking to drink less, while still enjoying their alcohol experience will be a challenge for those in public health, partly because any move to increase the recommended amount of alcohol in the current guidelines could be unhelpfully used by the alcohol industry (NHMRC, 2020). Nevertheless, if guidelines do not reflect or represent people's experiences they are likely to be ignored (e.g. Lovatt et al., 2015), and are unlikely to lead to the public health goal of reduced consumption. There is evidence from the persuasive communication literature that messages which are not deemed as being personally relevant are not attended to (Harris & Napper, 2005).

Unsurprisingly, and in line with previous research, the highest amount of alcohol needed to reach each point of intoxication associated with gender, age and AUDIT category. Women are generally less likely than men to engage in HED (Wilsnack, Wilsnack, Gmel, & Kantor, 2018) and pre-drinking (Ferris, Puljević, Labhart, Winstock, & Kuntsche, 2019). People under 25 years consistently reported consuming more drinks than those 25 and older to reach each stage of intoxication . People who were at higher risk for an alcohol use disorder also needed more grams of alcohol to reach each stage of intoxication, perhaps consistent with increased tolerance.

Respondents from the Republic of Ireland and France got as drunk as they wanted to be most frequently. Respondents from the Republic of Ireland also had the highest rate of reaching the tipping point at least monthly (31.7%). Results are similar to data from the WHO (2018) that showed that 38% of people in Ireland who currently drink alcohol reported heavy episodic drinking (HED) in the past 30 days. It is likely that these results reflect cultural differences in drinking practices between countries, as well as the acceptance of public drunkenness (Measham & Brain, 2005; Room & Makela, 2000).

Cultural differences in drinking patterns (Savic, Room, Mugavin, Pennay, & Livingston, 2016) and social pressures around drinking (Dietze, Ferris, & Room, 2013) may influence how much alcohol people drink until they reach their tipping point. Beyond these more objective differences between countries, there are also likely to be subjective differences between countries, particularly around the acceptability of reaching, and exceeding, the tipping point. Previous GDS research found that social embarrassment was a strong motivation for respondents in Germany to reduce their drinking (Davies, Conroy, Winstock, & Ferris, 2017), which may explain why these respondents avoid reaching the tipping point as frequently as others.

Limitations

The self-selecting sample and cross-sectional nature of the study are two clear limitations. GDS recruits large sample sizes, but due to the nature of recruitment, it is completed by a greater proportion of people who use illicit drugs, compared to the general population (Barratt et al., 2017). People who complete GDS are also generally better educated and younger than the general population. Country comparisons are limited by this lack of representativeness and therefore such comparisons should be interpreted with caution. Limitations of the survey items relating to the number of drinks that people selected must be considered. Firstly, people were asked to select their 'usual drink', which could clearly vary in both size and alcohol content,

impacting on the number of drinks that a person would need to feel each stage of intoxication. Although we asked respondents to pick a size indicating the amount of alcohol for each, it is possible that they ignored this and assumed we were talking about standard drinks. Country differences in standard drink sizes would therefore impact on these findings. Secondly, some people selected 'other' as their usual drink size, and their free text responses could not be converted to grams. There were differences between these respondents and the rest of the sample in terms of age, gender and AUDIT score, although the effect sizes for these associations were very weak. Thirdly, an administrative error with the survey meant that some people picked more than one usual drink, and we had to average the ABV for each drink type they picked. The respondents who selected all four types of alcohol reported consuming significantly more grams of alcohol to reach each stage of intoxication (although with small effect sizes). Related to this, many people may drink more than one type of drink on a night out, and they may use other drugs at the same time, despite the question asking them to imagine they are only consuming alcohol, and we are not able to account for this in the data. We acknowledge that using a binary outcome measure comparing weekly/monthly with less frequently reaching each stage of intoxication is another limitation of the study – in future a continuous measure should be applied. It is also important to acknowledge that other interpersonal factors, such as fatigue or mental health state, for example may influence how intoxicated someone feels on a particular occasion. Finally, the countries included were those where GDS had media and academic partners at the time of the survey, and these countries all happen to be located in regions where the majority of population currently drink alcohol (WHO, 2018). It is also worth considering that it is not only the number of drinks in a drinking occasion, but the time taken to consume those drinks that may impact on the experience of intoxication (Kuntsche, Plant, Plant, Miller, & Gmel, 2008). Drinking more in a short period of time increases the likelihood that an individual is reaching their tipping point more quickly.

Strengths and implications

This is the first study to explore the subjective effects of alcohol consumption in respondents from different countries. The study has strength in the size of the sample, as well as in exploring a novel question about how often people reach a desired and undesired stages of intoxication. Within this sample, the study has highlighted how country of residence may influence consumption. We found 20% of the sample reached their tipping point at least monthly, which means they are at least once monthly more intoxicated than they ideally want to be. Reaching the tipping point at least monthly or weekly was associated with age and AUDIT score, but interestingly, gender was rendered non-significant in the full model, adjusting for all co-variables. This suggests that interventions to reduce the frequency of reaching the tipping point need to be targeted at men and women, focussing on younger people with heavy drinking. In countries such as the UK, recent data shows that fewer young people are consuming alcohol (Ng Fat, Shelton, & Cable, 2018). Data from the current study suggests that this trend should not be seen as a sign to reduce prevention efforts, as those that do drink potentially consume at harmful levels.

Reducing instances of reaching the tipping point could be a useful place for targeted interventions and have benefits to long and short term health. Understanding the motivations to cut down could be a way to encourage moderate alcohol consumption. For example in a another GDS study, people in higher risk AUDIT categories were more likely to select motivations to reduce drinking related to violence and mental health issues (Davies et al., 2017). Our data suggests that it is important to target not only people with heavy drinking, but also people who reach their tipping point repeatedly. These people may not reach a threshold AUDIT score that suggests they would benefit from intervention, but their consumption beyond their tipping point may increase the risk of suffering acute harms.

Reaching the tipping point tends to be an unpleasant, negative experience (e.g. Burgess et al., 2019). Tailored interventions, for example, ecological momentary interventions (EMI), could be used to help people avoid this state. A recent study (Irvine et al., 2017), showed that men with

risky drinking patterns responded positively in real-time to text messages that delivered behaviour change interventions. More work on these methods is needed, but they could help to prevent people from exceeding their tipping point. In future the role of wearable technologies, such as transdermal measuring devices, or mobile phone data (Piasecki, 2019) could be used to flag if a person approaches their tipping point and then alert them to the need to slow down, or stop their consumption.

In addition to individual-level interventions it is also worth considering the messages about alcohol that are currently promoted in public health campaigns. Most messages (promoted by alcohol industry) advocate 'responsible', 'moderate' or 'safe' drinking with reference to national drinking guidelines. In Australia, the alcohol industry is currently lobbying for adjusting the guidelines to include pleasurable benefits of drinking. Communicating guidelines therefore involves a delicate balance between pragmatic concerns and scientific evidence (Holmes, Angus, Meier, Buykx, & Brennan, 2019). A pragmatic concern is that many people who drink alcohol exceed the recommended amounts provided in the guidelines (Knott, Scholes, & Shelton, 2013), which could reflect a lack of awareness of guidelines (Buykx et al., 2018) or rejection of guidelines as relevant for their drinking (Lovatt et al., 2015). It is worth noting that health guidelines shift the onus of responsibility onto the individual (Casswell, 2012), instead of the state, but if people find guidelines difficult to understand or simply do not care, then it is reasonable to ask if this approach is likely to be successful. A less healthy, although probably easier to implement, approach would be to communicate messages about staying in a pleasurable zone (i.e., happy drunk) and how to reduce the number of occasions where a tipping point is reached.

Conclusions

This study drew on a large sample of people who drink alcohol and explored a novel question in asking how many drinks it takes to get intoxicated, and how frequently people reach different

stages of intoxication. These findings have relevance for public health interventions to encourage people to reduce drinking, by focusing on an undesirable state, the 'tipping point'. Findings are also relevant for the communication of low risk drinking guidelines. Further research should examine people's experiences as they reach stage of intoxication and explore ways to target people who reach their tipping point more frequently in order to reduce alcohol related harms.

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TABLES AND FIGURES

Table 1: Demographic characteristics of GDS2015 respondents by country (N =61,043)

Country	N(of total sample)	Mean age (SD)	male	White	AUDIT Median (P25, P75)	AUDIT 0- 7	AUDIT 8- 15	AUDIT 16-19	AUDIT 20+	Feeling effects monthly/ weekly	Drunk as you want monthly/ weekly	Tipping point monthly/ weekly	Feel no effect monthly/ weekly
Australia	2629 (4.3)	34.9 (14.1)	65.5	91.2	8 (5, 13)	44.60	39.20	8.40	7.70	81.9	55.0	18.4	54.3
Austria	987 (1.6)	27.4 (8.2)	66.4	97.0	8(5, 11)	49.30	42.40	5.40	2.90	86.2	71.3	26.7	51.4
Belgium	1,431 (2.3)	28.0 (9.6)	69.5	94.9	9 (5, 13)	39.50	44.00	9.60	7.00	85.1	59.0	17.3	63.1
Brazil	3,319 (5.4)	24.6 (6.7)	58.3	62.9	8 (5, 13)	43.50	41.80	8.30	6.40	85.5	67.6	25.2	58.8
Canada	893 (1.5)	25.4(10.4)	38.3	86.8	8 (5,12)	44.10	43.20	8.10	4.60	87.5	64.2	19.8	52.7
Denmark	325 (0.5)	26.2 (8.0)	76.3	89.5	10 (7,13)	31.10	52.90	8.90	7.10	82.2	69.8	22.5	49.8
France	6,183 (10.1)	27.6(9.3)	61.6	90.8	10 (7, 14)	32.30	50.10	10.10	7.50	92.2	71.3	21.6	64.1
Greece	263 (.04)	27.8 (8.2)	81.4	99.2	7 (4, 10)	60.10	30.40	7.60	1.90	68.8	36.9	11.4	72.2
Germany	18,713 (30.7)	28.3 (9.4)	69.1	95.9	7 (4, 11)	54.20	37.10	5.60	3.10	84.7	68.8	19.9	46.6
Hungary	3,007 (4.9)	27.3 (8.0)	73.1	97.9	8 (5,12)	43.50	41.80	8.50	6.20	82.9	65.5	21.2	55.2
Republic of Ireland	1,764 (2.9)	24.5 (7.8)	53.1	96.9	11 (8, 16)	24.40	47.80	15.50	12.30	91.5	78.3	31.7	45.2

Drinking to excess and the tipping point

Italy	253 (.04)	30.1(10.2)	70.4	88.5	8 (5, 11)	47.40	38.70	8.70	5.10	85.8	58.9	16.2	62.1
Netherlands	4,411 (7.2)	23.0(6.4)	57.0	91.4	10 (7, 13)	32.70	50.20	10.70	6.40	87.3	64.3	18.0	44.1
New Zealand	2,239 (3.9)	34.4(13.5)	56.4	89.1	8 (5, 12)	47.10	38.50	7.10	7.30	78.8	49.7	13.8	61.1
Poland	288 (0.5)	24.7(6.9)	75.0	98.3	9.5 (6,14)	35.40	44.80	9.40	10.40	85.4	54.9	17.7	44.1
Portugal	802 (1.3)	30.4(9.0)	64.3	89.8	6 (4, 9)	60.60	32.00	4.70	2.60	78.2	51.2	13.1	73.1
Spain	581 (1.0)	29.7(10.1)	69.5	86.4	8 (5, 11)	48.20	40.30	6.40	5.20	88.8	64.0	20.3	64.4
Sweden	383(0.6)	27.2(8.2)	76.5	93.5	8 (5, 11)	47.50	39.70	8.90	3.90	80.2	61.4	10.2	39.9
Switzerland	3,392 (5.6)	28.4(10.3)	64.8	93.5	7 (4, 11)	56.30	35.50	5.50	2.70	82.0	60.1	16.7	56.6
United Kingdom	5,204 (8.5)	29.1(11.3)	67.9	93.7	9 (6, 14)	35.30	47.20	9.80	7.70	87.5	67.1	22.7	49.2
United States	3,976 (6.5)	26.7(11.4)	44.6	84.8	8 (5, 12)	49.00	39.30	6.40	5.40	84.5	62.8	21.2	51.6
Whole sample	61,043	27.9 (10.10)	63.7	91.5	8 (5,12)	45.2	41.6	7.8	5.4	85.5	65.6	20.3	53.3

Table 2: Comparison of daily and/or weekly low risk drinking guidelines in grams of pure alcohol between countries included in the study

Country	Daily		Weekly		Mean grams female			Mean grams male		
	Female	Male	Female	Male	Feel effects	As drunk as you want to be	Tipping point	Feel effects	As drunk as you want to be	Tipping point
Australia	20	20			33.37	77.22	109.44	40.20	99.80	149.38
Austria	16	24	112	168	26.32	51.70	86.98	33.01	69.99	117.42
Belgium	-	-	100	100	36.31	75.76	109.40	43.70	99.72	149.57
Brazil	20	30			43.65	84.60	133.71	49.57	103.85	172.26
Canada	27	40.7	136	204	33.57	78.50	113.77	36.62	93.52	137.90
Denmark	12	24	84	168	36.75	72.60	120.14	41.20	106.33	172.40
France	20	30	140	210	34.99	76.22	115.74	37.79	90.56	140.98
Greece	20-32	30-48			37.06	69.30	99.00	51.26	93.55	139.72
Hungary	17	34	-	-	32.70	65.45	102.65	39.65	85.23	137.99
Republic of Ireland	-	-	110	170	39.76	84.56	119.04	49.42	109.85	159.11
Italy	20	36	-	-	34.67	69.82	109.26	35.62	76.60	120.99
Netherlands	20	30			42.49	94.63	136.05	48.11	116.22	174.66
New Zealand	20	30	100	150	36.30	79.92	112.62	46.43	112.11	164.89
Poland	20	40	140	280	33.92	81.21	112.55	37.61	95.29	142.32
Portugal	10--24	10--24			35.13	68.70	108.09	46.04	93.26	153.01
Spain	-	-	110	170	32.61	66.28	96.19	36.41	80.82	118.17

Sweden	10	20	-	-	28.04	64.53	102.77	33.68	89.31	142.06
Switzerland	20-24	30-36	-	-	32.31	62.32	98.22	37.79	80.05	129.64
United Kingdom	-	-	112	112	34	79.14	113.2	40.43	99.74	144.13
United States	42	56	98	196	33.17	73.13	104.94	34.88	87.06	128.84
Germany	12	24			25.26	49.89	84.53	32.92	70.71	121.73

Information gathered from multiple sources (Eurocare, 2016; Furtwaengler & de Visser, 2013; Kalinowski & Humphreys, 2016; WHO, 2018)

Table 3: Comparisons between the mean grams of alcohol for each stage of intoxication for all respondents in the sample by gender, age group and AUDIT category (regardless of country of residence).

	Stage of intoxication		
	Feel the effects M (SD)	Feel happy drunk M (SD)	The tipping point M(SD)
Male (N =38,874)	38.51 (20.50)	87.55 (42.81)	138.65 (66.94)
Female (N =22,169)	33.14 (18.79)	70.16 (37.01)	106.54 (54.98)
Test statistic, <i>p</i> , effect size	t=32.84, p<.001, d=.273	t=52.69, p<.001, d = .435	t=64.03, p<.001, d = .524
Age <25 (N =29,714)	39.61 (20.86)	88.44 (42.59)	136.99 (66.05)
Age 25+ (N = 31,105)	33.66 (18.82)	74.39 (39.52)	117.47 (61.94)
Test statistic, <i>p</i> , effect size	t=36.89, p<.001, d=.300	t=42.13, p<.001, d=.342	t=37.55, p<.001, d=.305
AUDIT 0-7 (N =27,574)	30.69 (17.12)	65.02 (34.16)	102.94 (52.67)
AUDIT 8-16 (N =25,408)	39.66 (19.71)	90.16 (39.75)	140.12 (62.25)
AUDIT 16-19 (N =4,747)	44.89 (22.18)	104.19 (45.01)	161.18 (71.56)
AUDIT 20+ (N =3,314)	49.76 (25.67)	114.80 (50.46)	177.48 (81.87)
Test statistic, <i>p</i> , effect size	F= 1900.61 p<.001 eta squared = .085 ¥	F= 3491.72 p<.001 eta squared = .146 ¥	F= 3153.76 p<.001 eta squared = .134 ¥
Total N = 61,043			

Notes: ¥ = post hoc tests showed that all four AUDIT groups were significantly different from each other on the number of drinks reported to reach each stage of intoxication

Effect sizes: d is reported for t-tests - a value of .2 represents a small effect size, .5 a medium effect and .8 a large effect; eta squared is reported for ANOVAs – a value or .01 represents a small effect size, .06 a medium effect and >.14 a large effect size.

Table 4: Chi square tests to compare frequency of reaching each stage of intoxication weekly/monthly vs yearly or less frequently by socio-demographic characteristics – not accounting for country differences

Demographic measure	N	Stage of intoxication N(%)								
		Feel the effects			χ^2 p effect size	As drunk as you want to be		χ^2 p effect size	Tipping point	
		Yearly or less frequently	Weekly /monthly	Yearly or less frequently		Weekly /monthly	Yearly or less frequently		Weekly /monthly	
AUDIT				7541.77* V=.352			15010.71* V=.497			15519.16* V=.505
Lower risk (0-7)	22,574	7,769 (28.2)	19,805 (71.8)		16,511 (59.9)	11,063 (40.1)		26,642 (96.6)	932 (3.4)	
Increasing risk (8-15)	25,408	993 (3.9)	24,415 (96.1)		4,244 (16.7)	21,164 (83.3)		19,141 (75.3)	6,267 (24.7)	
Higher risk (16-19)	4,747	56 (1.2)	4,691 (98.8)		148 (3.1)	4,599 (96.9)		2,119 (44.6)	2,628 (55.4)	
Possible dependence (20+)	3,314	54 (1.6)	3,260 (98.4)		67 (2.0)	3,247 (98.0)		730 (22.0)	2,584 (78.0)	
Gender				116.32* V=.044			266.94* V=.066			66.19* V=.033
Female	22,169	3,677 (16.6)	18,492 (83.4)		8,543 (38.5)	13,626 (61.5)		18,052 (81.4)	4,117 (18.6)	
Male	38,874	5,195 (13.4)	33,679 (86.6)		12,427 (32.0)	26,447 (68.0)		30,580 (78.7)	8,294 (21.3)	
Age				361.56* V=.077			1145.93* V=.137			380.95* V=.079
<25	29,714	3,486 (11.7)	26,228 (88.3)		8,217 (27.7)	21,497 (72.3)		22,703 (76.4)	7,011 (23.6)	
25 +	31,105	5,339 (17.2)	25,766 (82.8)		12,657 (40.7)	18,448 (59.3)		25,748 (82.8)	5,357 (17.2)	

Notes: * p<001. Effect sizes: Cramer's V is reported –for 1 DF (age and gender) a value of .1 is a small effect, .3 is a medium effect and .5 a large effect. For 3 DF (AUDIT) .06 is a small effect, .17 is a medium effect and .29 a large effect.

Table 5: Results of multi-level logistic regression models with country included as a random effect. Table presents odds ratios, confidence intervals and significance of the showing variables associated with frequency of feeling each stage of intoxication at least **weekly/monthly** compared to **yearly or less frequently**.

	Stage of intoxication			
	Feel effects	Happy drunk	Tipping point	Feel no effects
	AOR (95% CI) p	AOR (95% CI) p	AOR (95% CI) p	AOR (95% CI) p
Male	1.12 (1.07-1.18), *	1.18 (1.13-1.23) *	.96 (.91-1.01)	1.03 (1.00-1.07)
Age	.99 (.99-.99) *	.97 (.97-.97) *	.99 (.98-.99) *	1.00 (1.00-1.00)
AUDIT 8-15	9.30 (8.67-9.98) *	7.91 (7.57-8.23) *	9.82 (9.13-10.56) *	1.52 (1.47-1.57) *
AUDIT 16-19	31.72 (24.33-41.36) *	52.53 (44.44-62.08) *	39.82 (36.41-43.56) *	1.57 (1.47-1.68) *
AUDIT 20+	23.71(18.04-31.17) *	86.93 (68.06-111.03) *	120.42 (108.04-134.21) *	1.66 (1.54-1.78) *
Intercept	3.05 (2.63 - 3.54) *	1.05 (.87-1.27)	.04 (.04-.05) *	.97 (.81-1.15)
REvar (SE)	0.13 (.04)	0.14 (.05)	0.10 (.03)	0.12 (.04)
ICC	0.018	0.033	0.014	0.028

Reference groups, gender = female, AUDIT = low risk, *p<.001 REvar = random effect variance

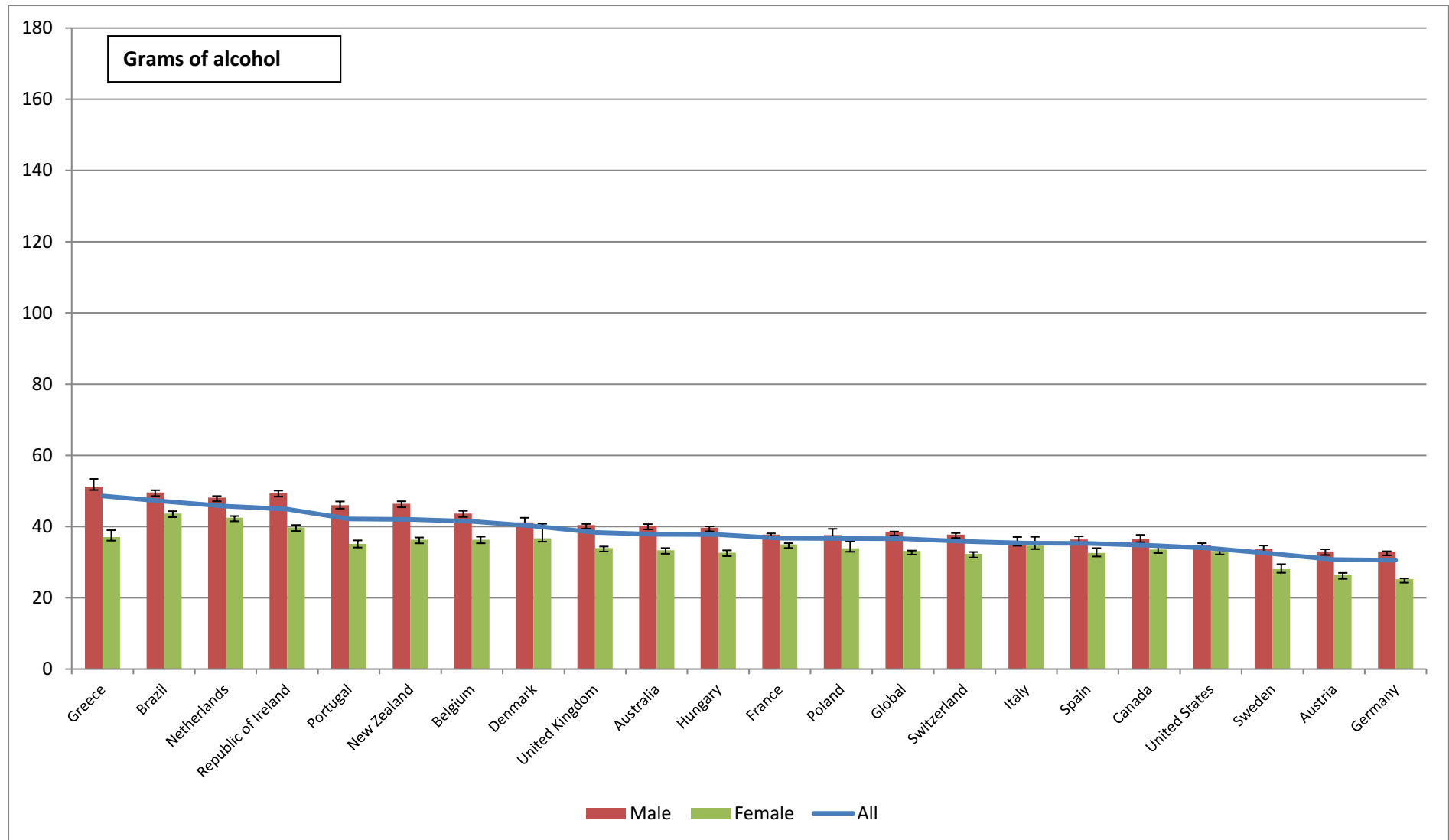


Figure 1: Mean grams of alcohol needed to **feel the effects of alcohol** by gender and country and difference between males and females. Error bars represent standard error. Data labels indicate the % difference between grams for males compared to grams for females in each country.

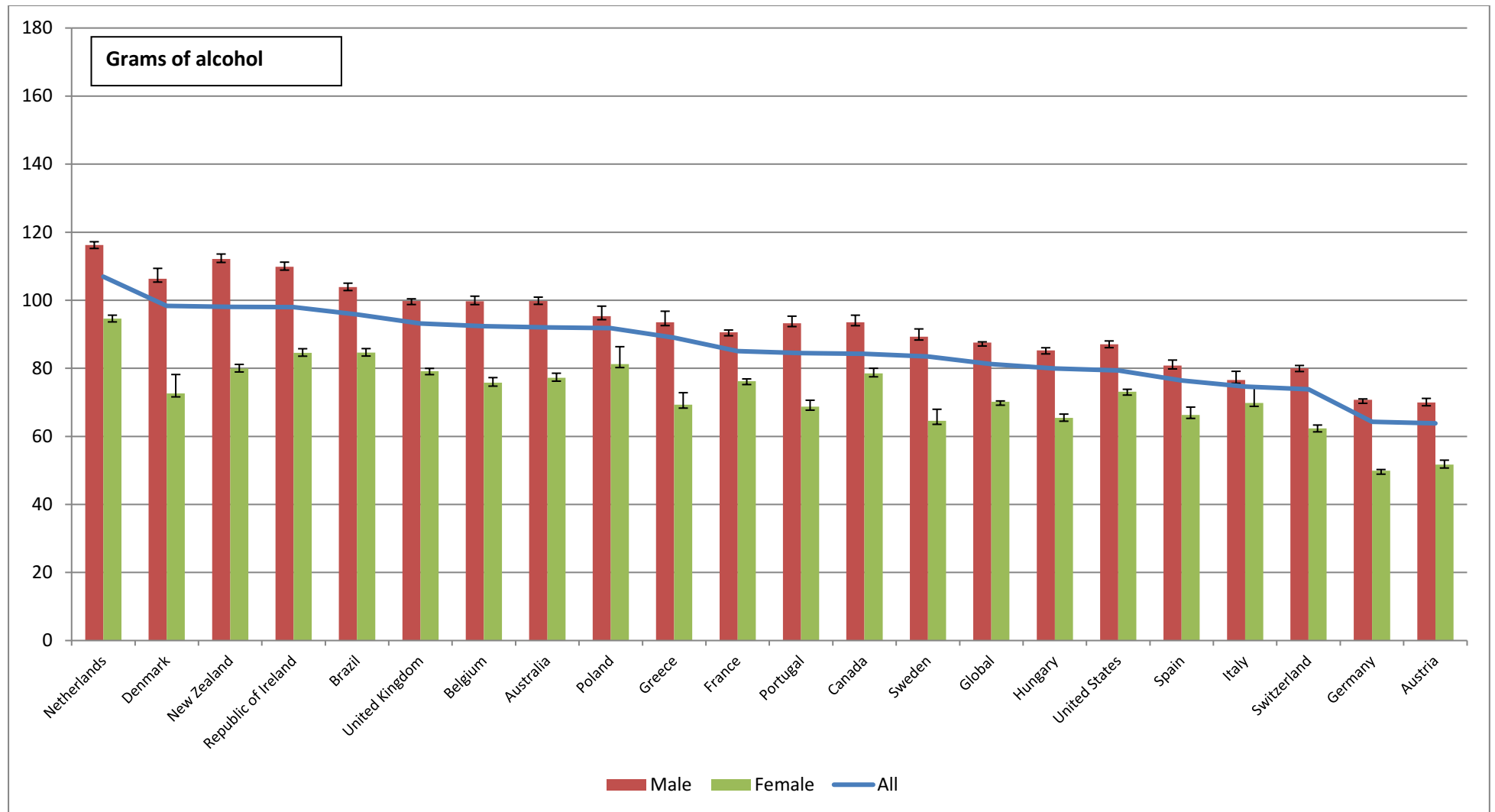


Figure 2: Mean grams of alcohol needed to **feel as drunk as you would like to be** by gender and country and difference between males and females. Error bars represent standard error. Data labels indicate the % difference between grams for males compared to grams for females in each country

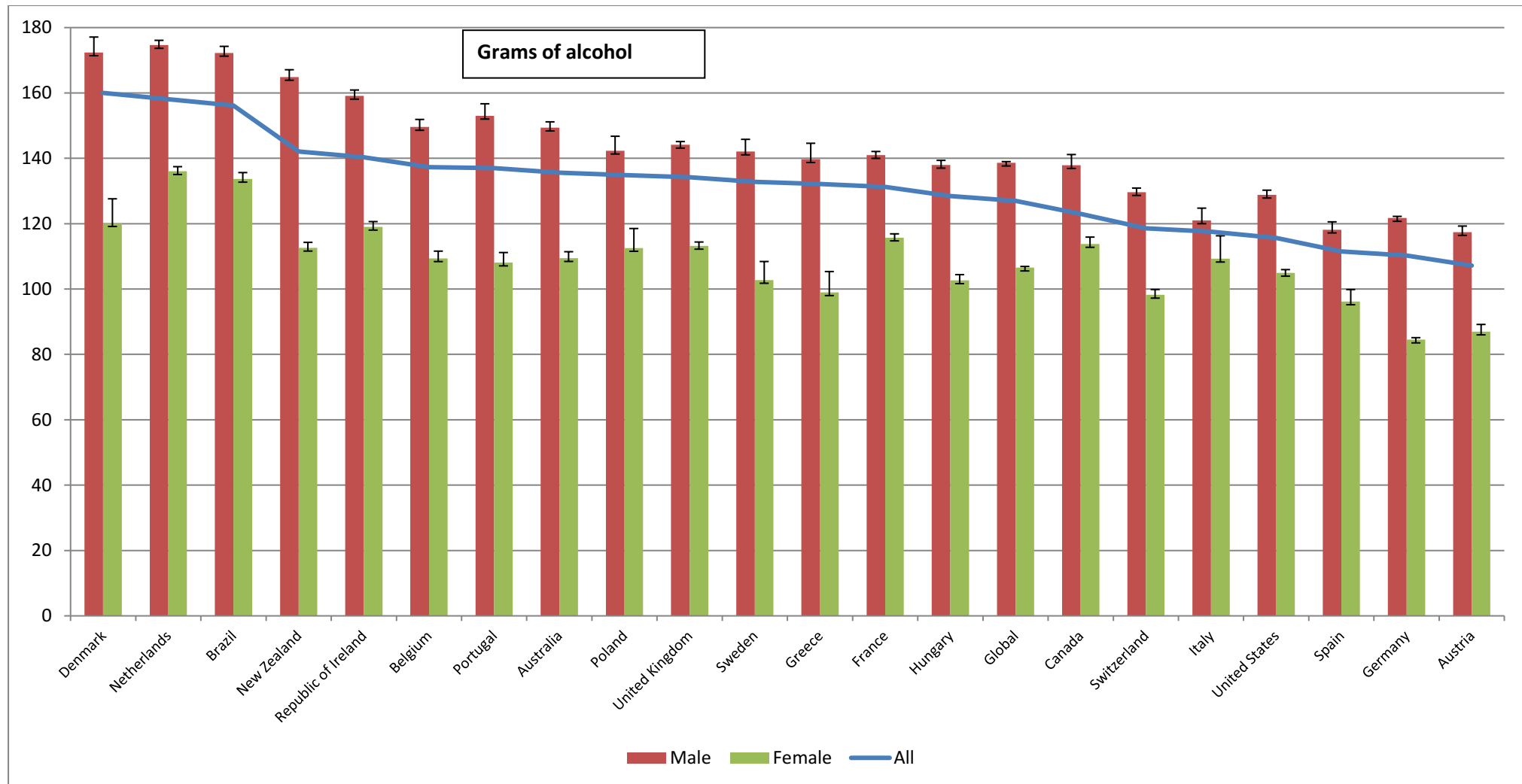


Figure 3: Mean grams of alcohol needed to reach the tipping point by gender and country and difference between males and females. Error bars represent standard error. Data labels indicate the % difference between grams for males compared to grams for females in each country.

Appendix A: Screen shots from GDS2015 used in the questions

