



## Potential alcohol use disorder among MSM in Ireland - Findings from the European MSM internet survey (EMIS 2017)

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### ARTICLE INFO

#### Keywords:

Men who have sex with men (MSM)

Alcohol use disorder (AUD)

Drug use

Depression/Anxiety

Homophobia

HIV/AIDS

### ABSTRACT

**Background:** Alcohol consumption is a major public health concern in Ireland. Alcohol use disorder (AUD) disproportionately affects men who have sex with men (MSM). However, little is known about the prevalence of AUD in this group in Ireland specifically, and the characteristics of MSM who may struggle with this.

**Methods:** The European MSM Internet Survey 2017 was an online, self-completed, anonymous questionnaire among MSM in Ireland. Standardised questions were used to explore a variety of topics. The validated CAGE-4 questionnaire was used to screen for potential AUD, defined as a CAGE-4 score of  $\geq 2$  out of 4. Multivariable-adjusted logistic regression analysis was used to identify factors associated with potential AUD.

**Results:** In total, 1793 MSM met inclusion criteria. 31 % screened positive for AUD. We observed higher odds of possible AUD among MSM who were bisexual (vs. gay/homosexual) (aOR 1.48 95 %CI 1.01–2.18), native to Ireland (vs. non-native) (aOR 1.49 95 %CI 1.12–1.96), unemployed (vs. employed) (aOR 1.80 95 %CI 1.02–3.16), had used illicit drugs in the previous year (vs. none) (cannabis only, aOR 1.74 95 %CI 1.14–2.63) (other illicit drugs, aOR 2.28 95 %CI 1.67–3.09), reported anxiety/depression (vs. none) (aOR 1.73 95 %CI 1.12–2.66), and MSM who experienced homophobic abuse (vs. never) (aOR 1.55 95 %CI 1.09–2.22). Student MSM were less likely to screen positive for AUD (vs. employed) (aOR 0.65 95 %CI 0.46–0.93).

**Conclusions:** The prevalence of AUD appears to be higher in the MSM population compared to the general male population in Ireland. Targeted interventions may be warranted to reduce the burden of AUD among MSM.

### 1. Introduction

Alcohol use disorder (AUD), which encompasses both alcohol abuse and alcohol dependence (American Psychiatric Association, 2013), is a pervasive public health problem that brings with it a myriad of physical, economic, and psychosocial ramifications (Medina-Mora et al., 2016). With over 100 million cases globally, AUD is considered the most common substance use disorder in both men and women (Degenhardt et al., 2018). The European region currently reports the highest prevalence of AUD worldwide (15 % of men and 4% of women) (Global status report on alcohol and health 2018, 2018), and Ireland has one of the

highest per-capita alcohol consumption rates (Manthey et al., 2019).

AUD has been linked to an array of chronic diseases, including a variety of cancers (Shield et al., 2013), and it is the leading risk factor for premature death worldwide in people aged 15–49 (Lim et al., 2012). In 2016, 12 % of male deaths globally in this age group were attributed to AUD (Griswold, 2018).

AUD has frequently been associated with adverse mental health outcomes, such as anxiety and depression (Johannessen et al., 2017), as well as risky sexual behaviours, including inconsistent condom use with new or multiple partners (Scott-Sheldon et al., 2016). Previous research proposes that AUD may disproportionately impact men who have sex

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<https://doi.org/10.1016/j.drugalcdep.2021.108698>

Received 10 November 2020; Received in revised form 23 February 2021; Accepted 23 February 2021

Available online 14 April 2021

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with men (MSM) (Hsiang et al., 2018; Irwin and Morgenstern, 2005). This is a cause for concern since MSM already face substantial health inequalities (Barrett et al., 2019). For example, MSM struggle with a higher prevalence of both anxiety and depression in comparison to the general population (King et al., 2008). They are also disproportionately impacted by sexually transmitted infections (STIs) and human immunodeficiency virus (HIV) (Folch et al., 2010; Li and McDaid, 2014; Sander et al., 2013). In 2018, 56 % of new HIV diagnoses in Ireland and 86 % of syphilis diagnoses were in MSM (Health Protection Surveillance Centre, 2019; Health Protection Surveillance Centre, 2019).

To date, there is a dearth of literature pertaining to both the prevalence of, and factors associated with, AUD in the MSM population in Ireland. Therefore, the aims of this study are to quantify this prevalence, and to identify the key demographic, behavioural, and psychosocial characteristics of MSM who may potentially struggle with AUD.

## 2. Methods

### 2.1. Study design

We used the Irish dataset from the European Men who have Sex with Men Internet Survey (EMIS) 2017. EMIS-2017 was an online, self-completed, anonymous questionnaire among gay, bisexual and other MSM carried out in 50 countries. The survey, which was coordinated by Sigma Research at The London School of Hygiene and Tropical Medicine (LSHTM), United Kingdom, officially began on 18<sup>th</sup> October 2017 and ran through to 31<sup>st</sup> January 2018. Participants could choose to take the survey in any one of 33 different languages. The majority of the questions were extracted from the survey's predecessor; EMIS-2010 (Weatherburn et al., 2019a). New questions were included based on topical developments affecting the health and wellbeing of MSM in the intervening period, including the availability of pre-exposure prophylaxis (PrEP).

In total, there were 409 items covering a wide variety of topics, such as demographics, relationship status, HIV and STI history, sexual characteristics, homophobic abuse, mental health, general substance use (alcohol, tobacco and illicit drugs), and substance use during sex. Full details on the survey have been reported elsewhere (Casey et al., 2019; Weatherburn et al., 2019b).

### 2.2. Study population and sampling

To be included in EMIS-2017, respondents had to firstly confirm that they read and understood the nature and purpose of the study. Participants had to identify as either a man and/or a trans man, and they were required to be sexually attracted to men and/or sexually active with men. To be included in the Irish dataset, participants had to be currently residing in Ireland, irrespective of their country of origin. MSM residing in Northern Ireland were excluded. Participants also had to be over the legal age of sexual consent in the country in which they lived (17 years of age in Ireland). Our study sample was restricted to those aged 18+ (to comply with University College Cork's ethics policies), and to those who consumed any amount of alcohol in the previous 12 months and had complete data recorded for the CAGE-4 questionnaire.

A multi-media recruitment strategy was used to recruit participants, including:

- 1 National statutory and non-governmental organisation (NGO) websites for MSM.
- 2 Social networking platforms including Facebook, Twitter and Instagram.
- 3 Geo-spatial smartphone applications and websites, such as Grindr, Hornet and Recon.

Study advertisements were also published in lesbian, gay, bisexual and transgender (LGBT+) newsletters, and a press release was issued for

print media. "Offline" methods of promotion included business cards and posters, which were disseminated at gay social and community venues to encourage further participation.

### 2.3. Measurements

#### 2.3.1. Outcome

Our primary outcome of interest was potential AUD. This was measured using an internationally-recognised, standardised screening tool; the CAGE-4 questionnaire. Men who reported drinking any amount of alcohol in the previous 12 months were asked the following four questions:

- 1 Have you tried to cut down on your drinking?
- 2 Have people annoyed you by criticising your drinking?
- 3 Have you felt bad or guilty about your drinking?
- 4 Have you taken a drink first thing in the morning to steady your nerves or get rid of a hangover?

Respondents screened positive if they answered "yes" to  $\geq 2$  questions. Although using an alternative cut-off value of  $\geq 3$  increases the specificity and positive predictive value (PPV) of CAGE-4, this has been shown to reduce the test's sensitivity by approximately two-fold in the MSM population (Chen et al., 2016). Therefore, a cut-off value of  $\geq 2$  is recommended to detect potential AUD with the optimal combination of sensitivity, specificity, and PPV (Dhalla and Kopec, 2007). We used a recoded variable to combine the above 4 responses to yield a binary outcome variable for potential AUD (yes/no).

#### 2.3.2. Covariates

Covariates were selected *a priori*, informed by a scoping literature review and consensus decision-making among an advisory group of national stakeholders. The final list of covariates was partly based on previous studies conducted among MSM in the Irish setting (Barrett et al., 2019; Carey et al., 2020; O'Connor et al., 2019; O'Donnell et al., 2019).

Age was analysed as a continuous variable. Education level (years spent in education after age 16) was recoded as a categorical variable. It was divided into 4 categories as follows; 0–3 years, 4–6 years, 7+ years, missing. The rationale for these specific categories was that 0–3 years included most participants who completed their education at or before the end of secondary school. Those with 4–6 additional years of education included most participants who had completed third-level education. Those with 7+ years included MSM who had pursued the highest level of education (e.g. post-graduates). Level of anxiety/depression (mild, moderate, severe) was measured using the patient health questionnaire-4 (PHQ-4), an ultra-brief combined screening tool for anxiety and depression (Kroenke et al., 2009). Recency of HIV testing was analysed as a binary variable (did not test/tested in the previous 12 months). Number of condomless anal intercourse (CAI) encounters with different partners in the last 12 months was collected as a continuous variable but was analysed as a categorical variable (0, 1–2, 3–5, 6+, missing). This variable included steady and/or non-steady CAI partners. We decided to analyse this as a categorical variable since MSM who reported zero CAI encounters may systematically differ from those with any other number of CAI encounters. Further details on the coding of the remaining covariates may be found in the appendix.

### 2.4. Statistical analysis

We firstly used descriptive statistics to compare baseline characteristics of the participants. Pearson's chi-square ( $\chi^2$ ) was utilised for tests of bivariate associations. Age was the only continuous variable in the regression models, and tests for normality indicated that it had a large positive skew. Thus, Wilcoxon's rank-sum test was used to compare the ages of those with or without potential AUD.

Multivariable-adjusted logistic regression was used to identify factors associated with a positive screening result for AUD. Regression models were constructed by adding 3 separate blocks of covariates sequentially. First, we adjusted for demographic variables, as well as sexual identity and level of outness (Model 1). Next, we adjusted for behavioural variables, including prior use of PrEP, number of CAI partners in the last 12 months, non-sober sexual encounters in the last 12 months, HIV testing recency, drug use in the previous 12 months, and recent history of STI diagnosis (Model 2). Finally, we adjusted for psychosocial variables, which included financial coping status, level of anxiety/depression, and prior experiences of homophobic abuse (Model 3).

The main analysis was restricted to MSM who were not previously diagnosed with HIV. This was done to reduce the possibility of differential misclassification bias, as HIV-positive participants may systematically differ in some aspects, including their recency of HIV testing and engagement with healthcare services. Furthermore, diagnosed HIV-positive men tend to be older and may be more likely to report CAI encounters, particularly those with a higher viral load (Wilson et al., 2016). A sensitivity analysis focusing on HIV-positive MSM was undertaken and can be found in the appendix.

We subsequently performed other sensitivity analyses. First, we applied stricter criteria to our outcome variable, wherein we qualified individuals as screening positive for possible AUD only if they answered “yes” to ≥3 questions. We undertook this sensitivity analysis in order to increase the specificity and PPV of CAGE-4 (Chen et al., 2016). Second, we created a binary outcome variable (yes/no) for individuals who answered “yes” to all four CAGE-4 questions, which was originally described as pathognomonic for alcoholism (Ewing, 1984), and/or those who had ever consulted a health professional specifically for their alcohol use concerns. This encompassed those with the most problematic and clinically significant pattern of alcohol consumption.

We assessed collinearity between independent variables using the variance inflation factor (VIF) method. All variables were below the often-cited threshold of 10, suggesting that multicollinearity was not an issue (Yoo et al., 2014). It has been asserted that less than or equal to 5% missing data is relatively inconsequential (Dong and Peng, 2013). Therefore, where 5% or more data were missing for an explanatory variable, indicator variables were created and included in the regression models.

All analysis was performed using Stata version 15.0 (StataCorp., TX, USA). Two-sided significance tests were used, where all p-values were compared against a pre-set alpha level of significance set at 5%.

### 2.5. Ethical considerations

Ethical approval for EMIS-2017 was granted by the Observational Research Ethics Committee at LSHTM [reference 14,421/RR/8805]. For this paper, a Data Transfer Agreement was approved by LSHTM and UCC. The Social Research Ethics Committee (SREC) in UCC granted approval for this study in February 2020.

## 3. Results

In total, 1793 participants (86.1 % of overall sample) that were aged 18 years or older, were not previously diagnosed with HIV, had consumed alcohol in the previous 12 months, and who had complete CAGE-4 data recorded were included in the sample. Their median age was 32 years (range 18–74 years).

### 3.1. Potential alcohol use disorder

Overall, 555 (31 %) out of all MSM who consumed alcohol within the previous year met the criteria for possible AUD (or 29 % if including those who did not consume any alcohol within the same period). 208 MSM (11.6 %) answered “yes” to ≥3 questions on CAGE-4, and 42 (2.3

%) answered “yes” to all 4 questions. Out of those who answered “yes” to ≥2, ≥3 and all 4 questions on CAGE-4, 14.1 %, 24.5 % and 45.2 %, respectively, had previously consulted a health professional for concerns relating to their use of alcohol.

### 3.2. Baseline characteristics

When comparing baseline characteristics of the participants (Table 1), those who reported potential AUD were significantly more likely to be unemployed (vs. employed), have used illicit drugs in the previous 12 months (vs. none), be native to Ireland (vs. non-native), and have a history of an STI diagnosis (vs. none). They were significantly

**Table 1**  
Baseline characteristics of MSM included in the study sample (N = 1793).

	Potential AUD	None	χ <sup>2</sup>	P-value
<b>Age → median (IQR)</b>	31 (25–40)	32 (25–42)		0.26 <sup>^</sup>
<b>Education &gt;16 years →</b>	103 (18.6) 219	245 (19.8)	1.21	0.75
<b>N (%) 0–3 years 4–6</b>	(39.4) 178	485 (39.2)		
<b>years +7 years Missing</b>	(32.1) 55 (9.9)	403 (32.5)		
		105 (8.5)		
<b>Employment → N (%)</b>	409 (74.4) 34	898 (72.6) 42	<b>10.61</b>	<b>0.01</b>
<b>Employed</b>	(6.2) 87 (15.8)	(3.4) 241		
<b>Unemployed Student</b>	20 (3.6)	(19.5) 56		
<b>Other <sup>+</sup></b>		(4.5)		
<b>Area of residence → N</b>	312 (56.2) 206	650 (52.5)	4.81	0.09
<b>(%) Dublin Outside</b>	(37.1) 37 (6.7)	523 (42.2) 65		
<b>Dublin Missing</b>		(5.3)		
<b>Country of birth → N</b>	111 (20.1) 442	328 (26.6)	<b>8.68</b>	<b>0.003</b>
<b>(%) Outside Ireland</b>	(79.9)	907 (73.4)		
<b>Ireland</b>				
<b>Sexual identity → N (%)</b>	447 (80.5) 77	1011 (81.7)	1.10	0.58
<b>Gay/Homosexual</b>	(13.9) 31 (5.6)	151 (12.2) 76		
<b>Bisexual Other <sup>†</sup></b>		(6.1)		
<b>Outness → N (%) None</b>	27 (5.0) 126	79 (6.5) 331	6.36	0.10
<b>Less than half More</b>	(23.0) 98 (17.9)	(27.1) 219		
<b>than half All or almost</b>	296 (54.1)	(18.0) 591		
<b>all</b>		(48.4)		
<b>Ever used PrEP → N (%)</b>	529 (96.2) 21	1168 (94.9)	3.66	0.16
<b>No Yes</b>	(3.8)	63 (5.1)		
<b>CAI in last 12 m <sup>¶</sup> → N</b>	185 (33.3) 237	483 (39.0)	7.72	0.10
<b>(%) 0 1–2 3–5 6+</b>	(42.7) 50 (9.0)	465 (37.6)		
<b>Missing</b>	44 (8.0) 39	114 (9.2) 108		
	(7.0)	(8.7) 68 (5.5)		
<b>Non-sober sex in last</b>	95 (17.1) 131	100 (8.1) 163	<b>99.30</b>	<b>&lt;0.001</b>
<b>12 m → N (%) All/</b>	(23.6) 108	(13.2) 193		
<b>almost all Half or more</b>	(19.5) 186	(15.6) 702		
<b>Less than half None/</b>	(33.5) 35 (6.3)	(56.7) 80		
<b>almost none Missing</b>		(6.4)		
<b>HIV test in last 12 m →</b>	219 (39.5) 336	550 (44.4)	3.86	0.05
<b>N (%) Did not test</b>	(60.5)	688 (55.6)		
<b>Tested</b>				
<b>Drug use in last 12 m →</b>	142 (26.0) 51	512 (42.2)	<b>83.43</b>	<b>&lt;0.001</b>
<b>N (%) None Cannabis</b>	(9.3) 90 (16.5)	107 (8.8) 259		
<b>only Poppers only</b>	27 (5.0) 236	(21.4) 54		
<b>Cannabis/poppers</b>	(43.2)	(4.5) 280		
<b>Other illicit drugs</b>		(23.1)		
<b>Ever had an STI → N</b>	300 (55.6) 240	758 (62.3)	<b>7.18</b>	<b>0.007</b>
<b>(%) No Yes</b>	(44.4)	458 (37.7)		
<b>Financial Coping → N</b>	271 (48.9) 173	618 (50.0)	4.24	0.12
<b>(%) Comfortable</b>	(31.2) 110	420 (34.0)		
<b>Managing Struggling</b>	(19.9)	198 (16.0)		
<b>Anxiety/Depression →</b>	175 (31.9) 220	584 (47.7)	<b>41.16</b>	<b>&lt;0.001</b>
<b>N (%) None Mild</b>	(40.2) 91 (16.6)	408 (33.3)		
<b>Moderate Severe</b>	62 (11.3)	133 (10.9) 99		
		(8.1)		
<b>Homophobic abuse <sup>‡</sup> →</b>	85 (15.3) 275	300 (24.3)	<b>20.91</b>	<b>&lt;0.001</b>
<b>N (%) Never Yes, &gt;6</b>	(49.6) 195	588 (47.6)		
<b>months ago Yes, &lt;6</b>	(35.1)	347 (28.1)		
<b>months ago</b>				

<sup>^</sup>: Wilcoxon’s rank-sum test <sup>+</sup>: Retired, on long-term sick leave, or other <sup>†</sup>: Any other term, or do not use a term <sup>¶</sup>: Number of CAI encounters with different steady and/or non-steady partners <sup>‡</sup>: Intimidated, insulted, and/or physically assaulted.

more likely to screen positive for anxiety/depression, and were also more likely to report homophobic abuse previously.

3.3. Multivariable-adjusted logistic regression analysis

In the multivariable-adjusted model (Table 2), the odds of potential AUD were significantly lower in students (vs. employed) (aOR 0.65 95 % CI 0.46–0.93) and in those who had previously used PrEP (vs. never) (aOR 0.50 95 % CI 0.27–0.94). The odds of potential AUD were higher in unemployed MSM (vs. employed) (aOR 1.80 95 % CI 1.02–3.16), those born in Ireland (vs. outside Ireland) (aOR 1.49 95 % CI 1.12–1.96), as well as those with bisexual identity (vs. gay/homosexual) (aOR 1.48 95 % CI 1.01–2.18). MSM who consumed cannabis (aOR 1.74 95 % CI

1.14–2.63) or any other illicit drugs (aOR 2.28 95 % CI 1.67–3.09) in the previous 12 months were more likely to screen positive (vs. no drug consumption).

We observed a gradient effect for the relationship between the timing of the last incident of homophobic abuse with a positive screening result for AUD. Those who experienced homophobic abuse over 6 months ago (vs. never) were significantly more likely to have a positive screening result for AUD (aOR 1.48 95 % CI 1.06–2.07), as were those who experienced it more recently (vs. never) (aOR 1.55 95 % CI 1.09–2.22). Over the previous year, men who only engaged in sober sexual encounters (aOR 0.35 95 % CI 0.24–0.50), or men who were at least sober for more than half of their encounters (aOR 0.63 95 % CI 0.42–0.95), were less likely to screen positive for potential AUD (vs. men who were under the

**Table 2**  
Factors associated with possible AUD (“yes” to two or more CAGE-4 questions) among MSM in Ireland (N = 1793).

	Potential AUD N (%)	Crude OR	95%CI	Model 1 Adjusted OR	95%CI	Model 2 Adjusted OR	95%CI	Model 3 Adjusted OR	95%CI
<b>Age</b>	555 (31.0)	0.99	(0.98, 1.00)	<b>0.99*</b>	<b>(0.98, 0.99)</b>	0.99	(0.98, 1.00)	1.00	(0.99, 1.01)
<b>Education &gt;16 years</b>	103 (29.6)	1.07	1.05	Ref (0.81, 1.42)	(0.78, 1.40)	1.11	(0.77, 1.44)	1.06	(0.74, 1.40)
<b>4–6 years</b>	219 (31.1)	1.23		1.21	(0.78, 1.40)	1.11	(0.76, 1.40)	1.06	(0.70, 1.36)
<b>+7 years Missing</b>	55 (34.4)				(0.83, 1.84)		(0.80, 1.83)		(0.67, 1.68)
<b>Employment</b>	409 (31.3)	<b>1.78*</b>		<b>1.92**</b>	<b>Ref (1.12, 2.84)</b>	<b>1.92*</b>	<b>Ref (1.13, 3.26)</b>	<b>1.80*</b>	<b>Ref (1.02, 3.16)</b>
<b>Employed</b>	34				(0.61, 1.04)		(0.49, 0.92)		(0.62, 2.21)
<b>Unemployed</b>	87 (26.5)	0.80	0.79	<b>0.67*</b>	1.00	<b>0.69*</b>	1.25	<b>0.65*</b>	1.17
<b>Student</b>	20 (26.3)				(0.47, 1.33)		(0.57, 1.76)		(0.62, 2.21)
<b>Other +</b>									
<b>Area of residence</b>	312 (32.4)	1.02	1.19	Ref (0.67, 1.02)	(0.78, 1.82)	1.03	(0.73, 1.18)	1.03	(0.73, 1.19)
<b>Dublin</b>	206 (28.3)				(0.78, 1.82)		(0.73, 1.18)		(0.82, 2.20)
<b>Outside Dublin</b>	37 (36.3)								
<b>Missing</b>									
<b>Country of birth</b>	111 (25.3)	<b>1.44**</b>		<b>1.47**</b>	<b>Ref (1.13, 1.84)</b>	<b>1.45**</b>	<b>Ref (1.11, 1.91)</b>	<b>1.49**</b>	<b>Ref (1.12, 1.96)</b>
<b>Outside Ireland</b>	442 (32.8)				(1.13, 1.84)		(1.11, 1.91)		(1.12, 1.96)
<b>Ireland</b>	77 (30.7)	1.16	0.93	0.92	(0.86, 1.56)	0.84	(0.98, 2.08)	0.89	(1.01, 2.18)
<b>Gay/</b>	31 (29.0)				(0.60, 1.43)		(0.48, 1.47)		(0.50, 1.58)
<b>Homosexual</b>									
<b>Bisexual</b>									
<b>Other †</b>									
<b>Outness</b>	27 (25.5)	1.11	1.30	Ref (0.69, 1.80)	(0.79, 2.14)	1.12	(0.73, 2.03)	1.08	(0.60, 1.85)
<b>None</b>	126 (27.6)	1.46		1.59	(0.79, 2.14)	1.12	(0.82, 2.41)	1.06	(0.58, 1.99)
<b>Less than half</b>	98 (30.9)				(0.92, 2.31)		(0.95, 2.65)		(0.59, 1.90)
<b>More than half</b>	296 (33.4)								
<b>All or almost all</b>									
<b>Ever used PrEP</b>	529 (31.1)	0.74			(0.45, 1.22)	<b>1.45*</b>	<b>Ref (0.25, 0.83)</b>	<b>1.50*</b>	<b>Ref (0.27, 0.94)</b>
<b>No</b>	21 (25.0)								
<b>Yes</b>									
<b>CAI in last 12 m ‡</b>	185 (27.7)	<b>1.32*</b>		<b>1.05,</b>	<b>1.67</b>	<b>1.29</b>	<b>0.91</b>	<b>1.27</b>	<b>0.95</b>
<b>0</b>	237 (33.8)				(0.78, 1.65)		(0.98, 1.57)		(0.61, 1.47)
<b>1–2</b>	50 (30.5)	1.14	1.06		(0.72, 1.57)		(0.83, 2.17)		(0.45, 1.18)
<b>3–5</b>	39 (28.9)	1.50			(0.98, 2.30)				(0.79, 2.14)
<b>6+ Missing</b>	39 (36.4)								
<b>Non-sober sex in last 12 m</b>	95 (48.7)	0.84		Ref (0.59, 1.21)	(0.41, 0.85)	0.82	(0.56, 1.22)	0.89	(0.60, 1.33)
<b>All/almost all</b>	108 (44.6)	<b>0.59**</b>			(0.41, 0.85)	<b>0.60*</b>	<b>Ref (0.40, 0.90)</b>	<b>0.63*</b>	<b>Ref (0.42, 0.95)</b>
<b>Half or more</b>	186 (35.9)	<b>0.28***</b>			(0.20, 0.39)	<b>0.34***</b>	<b>0.24</b>	<b>0.35***</b>	<b>0.24</b>
<b>Less than half</b>	186 (20.9)	<b>0.46**</b>			(0.28, 0.75)	<b>0.64</b>	<b>0.36</b>	<b>0.66</b>	<b>0.50</b>
<b>None/almost none</b>	35 (30.4)								(0.37, 1.19)
<b>Missing</b>									
<b>HIV test in last 12 m</b>	219 (28.5)	1.22		Ref (1.00, 1.50)		1.07	(0.83, 1.38)	1.09	(0.85, 1.41)
<b>Did not test</b>	336 (32.8)								
<b>Tested</b>									
<b>Drug use in last 12 m</b>	142 (21.7)	<b>1.72**</b>		<b>1.17,</b>	<b>2.52</b>	<b>1.74**</b>	<b>Ref (1.16, 2.63)</b>	<b>1.74*</b>	<b>Ref (1.14, 2.63)</b>
<b>None</b>	51 (32.3)				(0.92, 1.69)	1.50	(0.84, 1.65)	1.50	(0.82, 1.66)
<b>Cannabis only</b>	236 (33.3)	<b>1.80*</b>			(1.10, 3.00)	<b>2.34***</b>	<b>1.74,</b>	<b>2.28***</b>	<b>1.66</b>
<b>Cannabis/poppers only</b>	236 (45.7)	<b>3.03***</b>			(2.35, 3.90)		(1.74, 3.15)		(1.67, 3.09)
<b>Cannabis/poppers/other illicit drugs</b>									
<b>Ever had an STI</b>	300 (28.4)	<b>1.32**</b>		<b>1.07,</b>	<b>1.62</b>	1.25	(0.97, 1.61)	1.22	(0.94, 1.58)
<b>No</b>	240 (34.4)								
<b>Yes</b>									
<b>Financial Coping</b>	271 (30.5)	1.09	1.27	Ref (0.75, 1.18)	(0.97, 1.67)			1.08	(0.62, 1.05)
<b>Comfortable</b>	173 (29.2)								(0.65, 1.30)
<b>Managing</b>	110 (35.7)								
<b>Struggling</b>									
<b>Anxiety/Depression</b>	175 (23.1)	<b>1.81***</b>		<b>1.43,</b>	<b>2.28</b>			<b>1.79***</b>	<b>Ref (1.37, 2.34)</b>
<b>None</b>	220 (35.0)				(1.66, 3.12)			<b>2.24***</b>	<b>1.56</b>
<b>Mild</b>	91 (40.6)	<b>2.27***</b>			(1.46, 3.00)			<b>1.73*</b>	<b>3.22</b>
<b>Moderate</b>	62 (38.5)	<b>2.10***</b>							(1.12, 2.66)
<b>Severe</b>									
<b>Homophobic abuse ‡</b>	85 (22.1)	<b>1.65***</b>		<b>1.24,</b>	<b>2.18</b>			<b>1.48*</b>	<b>Ref (1.06, 2.07)</b>
<b>Never</b>	195 (31.9)				(1.47, 2.66)			<b>1.55*</b>	<b>1.09</b>
<b>Yes, &gt;6 months ago</b>	275 (36.0)								(2.22)
<b>Yes, &lt;6 months ago</b>									

+: Retired, on long-term sick leave, or other †: Any other term, or do not use a term ‡: Number of CAI encounters with different steady and/or non-steady partners ‡: Intimidated, insulted, and/or physically assaulted \*: p < 0.05 \*\*: p < 0.01 \*\*\*: p < 0.001.



within the last 12 months, and screening positive for a mild (aOR 1.89 95 %CI 1.11–3.21) or a moderate (aOR 2.02 95 %CI 1.03–3.96) level of anxiety/depression.

A sensitivity analysis focusing on HIV-positive MSM only may be found in the appendix (Table 5). In total, 138 participants (6.6 %) were over the age of 18, were HIV-positive, had consumed alcohol within the previous 12 months, and had complete data recorded on alcohol consumption patterns. Of these, 39 (28.3 %) answered “yes” to  $\geq 2$  questions on CAGE-4. This analysis found that HIV-positive MSM who were struggling financially (vs. comfortable) (aOR 13.29 95 %CI 2.15–82.05), and/or who screened positive for a mild level of anxiety/depression (vs. none) (aOR 6.76 95 %CI 1.93–23.64), were more likely to report potential AUD.

## 4. Discussion

### 4.1. Principal findings

To our knowledge, this study is the first to explore the factors associated with potential AUD among MSM in Ireland. MSM are more likely to experience a range of health inequalities in comparison to the general population, including those relating to mental health, sexual health and substance use. As these areas often overlap (Public Health England, 2014), substance use may therefore be an important contributory factor to the overall health and wellbeing of MSM. Although EMIS-2017 covered a wide variety of topics, our study mainly contributes to knowledge around substance use and dependence, and our findings suggest a possible AUD prevalence as high as 31 % among men who consumed any amount of alcohol in the previous 12 months (or 29 % if including those who did not consume alcohol within the same time period). This far exceeds the estimated prevalence of 9% in the general Irish male population (Long and Mongan, 2014). It also exceeds the estimated prevalence of 18 % among all European MSM although importantly, the denominator for the latter estimate includes non-drinkers and HIV-positive MSM (Weatherburn et al., 2019b).

A previous study of alcohol dependence, now qualified as AUD under DSM-V, among MSM in Boston, USA, yielded a similar estimation, reporting a prevalence of 25 % (Seage et al., 1998). In this study, the same CAGE-4 questionnaire was employed in order to assess alcohol dependence, wherein a cut-off value of  $\geq 2$  was utilised. However, a similar study conducted in a sample of MSM in Chicago, USA, used DSM-IV criteria to evaluate alcohol dependence, and yielded a prevalence of only 16 % (Mackesy-Amiti et al., 2010). DSM-IV is the diagnostic measure of assessing true alcohol dependence in comparison to CAGE-4 which, although internationally-validated, is still only a screening tool (Chen et al., 2016). Nonetheless, since Ireland is already an international outlier in terms of alcohol consumption, the higher prevalence of potential AUD in MSM is a matter of particular concern (Weatherburn et al., 2019b).

MSM who had a positive screening result for depression/anxiety, or who recently experienced homophobic abuse, were also found to have higher odds of potential AUD. The same groups of men who reported potential AUD were more likely to have used cannabis or any other illicit drugs in the previous 12 months. These results were consistent with previous literature (Folch et al., 2010; Johannessen et al., 2017; Scott-Sheldon et al., 2016), but we cannot delineate any temporal association. Reverse causality must be considered as a possibility in this regard, particularly for the relationship between AUD and depression/anxiety, given the cross-sectional nature of the study. Importantly, Meyer's minority stress theory (Meyer, 1995, 2003), the dominant theoretical framework used to understand health inequalities among minority groups, should be considered. Distal stressors, such as discrimination and rejection, may contribute to proximal stressors, including internalised homophobia, expectations of rejection, and concealment of sexual orientation (Meyer, 2003). Consequently, the associated physiological responses to chronic stress, e.g., anxiety and/or

high blood pressure, result in poorer physical health and psychological wellbeing. Thus, individuals may turn to substance misuse as a maladaptive coping mechanism (Parent et al., 2018).

Self-identified bisexual MSM were more likely to report potential AUD, which is consistent with previous studies (Feinstein and Dyar, 2017; Russell et al., 2002). In particular, prior research has demonstrated that behaviourally bisexual MSM are more likely to report AUD compared to exclusively homosexual men (Feinstein and Dyar, 2017). Although the reasons underlying this are likely multifactorial, it has been suggested that bisexual MSM may grapple with some degree of stigma or discrimination (distal stressors) from both heterosexual and gay communities (Israel and Mohr, 2004; Lehavot et al., 2009). Thus, these individuals are more likely to experience additional internalised stigma and are even more likely to conceal their sexual orientation (proximal stressors) (Schrimshaw et al., 2018). This may contribute to the disparity of potential AUD that we observe among bisexual MSM, consistent with Meyer's minority stress theory.

Our study has shown that unemployed MSM were significantly more likely to report possible AUD. Indeed, sexual minority groups may experience hate and discrimination in the workplace (Meyer, 2003). Greater ambient workplace heterosexism can be associated with heightened fear and anger among sexual minorities which, in turn, can lead to increased psychological distress, more physical health complaints, lower job satisfaction, and of particular relevance; increased job turnover (Miner and Costa, 2018). Conversely, student MSM in our study were less likely to screen positive for AUD. However, CAGE-4 has consistently performed poorly in previous validation studies in both adolescents and college students, yielding a sensitivity of only 37 % in the former and 42 % in the latter, even when using a cut-off value as low as  $\geq 1$  (Aertgeerts et al., 2000; Knight et al., 2003). This may bias our findings away from null due to greater false negative results.

A large body of research has linked risky sexual behaviours with increased alcohol consumption, including among MSM (Folch et al., 2010; Li and McDaid, 2014; Sander et al., 2013). The *Multicentre AIDS Cohort Study* (MACS), a large ongoing USA-based longitudinal study, reported that between the years 1984–2008, those who were at a significantly increased risk of seroconverting to a positive HIV status (aHR 1.61 95 %CI 1.12–2.29) were more likely to be heavy-drinkers (vs. non-drinkers) (Sander et al., 2013). Respondents in our study who answered “yes” to  $\geq 3$  CAGE-4 questions were more likely to report multiple CAI encounters with different partners in the previous 12 months. Of note, MACS took place in an era preceding the availability of PrEP, but its findings remain important in the context of STI control efforts.

Despite international validation for use of CAGE-4 in the general population, there is a paucity of literature examining the validity and reliability of CAGE-4 in the MSM population specifically. This is particularly pertinent as its validity has differed across certain populations to date, having yielded poorer sensitivities in adolescents/students and women (Aertgeerts et al., 2000; Bisson et al., 1999; Knight et al., 2003). To our knowledge, only one study has assessed the validity of CAGE-4 in MSM thus far (Chen et al., 2016). The sensitivity, specificity, and PPV for a cut-off score of  $\geq 2$  were 47 %, 90 %, and 24 %, respectively. When using a cut-off score of  $\geq 3$ , the reported values were 22 %, 96 %, and 27 %. This study was conducted in China, where there is considerable stigmatisation surrounding alcohol consumption in the MSM population due to the expanding HIV burden in this subgroup (Chen et al., 2016). As such, the results of this study may not be generalisable to the European context.

### 4.2. Strengths and limitations

There are a number of strengths associated with this study. Firstly, EMIS-2017 was available in any one of 33 different languages. This is in contrast to the *MSM Internet Survey Ireland (MISI) 2015*, the largest previous study conducted in MSM in Ireland, which was only available

in English (O'Donnell et al., 2016). This encouraged wider participation from people who may not speak English as their first language. Secondly, it is possible that the anonymity of an online survey reduced social desirability bias and boosted the internal validity of the study. Indeed, it has been suggested that online surveys are the preferred method to assess overall substance use in MSM (Perlis et al., 2004), and previous studies have determined that internet reporting of alcohol consumption patterns yields similar measurements of quality when compared to self-administered postal questionnaires and face-to-face and/or telephone interviews (Hines et al., 2010; Khadjesari et al., 2009).

However, the study is not without limitations. Firstly, the cross-sectional design precludes us from determining causality for observed associations. Secondly, all data were self-reported. Therefore, the results could be impacted by recall bias, as respondents were asked to recall numerous events over a prolonged period of time. Thirdly, convenience sampling was employed to recruit participants. This encourages participation from those who are more familiar with technology. Selection bias could be an issue in this regard as the older population of MSM in Ireland may be underrepresented. This is likely the case as the median age was 32 years, and only 2.2 % of participants were aged over 60. Furthermore, misclassification error may be an issue as individuals were not excluded from participating in the study even if they lived outside of Europe, as long as they selected a European country as their place of residence. Lastly, we used collapsed categories for certain variables in our analysis to reduce the requirement for a Bonferroni correction (Chen et al., 2017). However, this may have resulted in reduced variability within the overall dataset (Altman and Royston, 2006).

#### 4.3. Public health implications

In Ireland, population-based efforts are ongoing to reduce the nation's per capita alcohol consumption. The Public Health (Alcohol) Act 2018 sought to reduce Ireland's per capita consumption from 13.0 L in 2016 (Alcohol Consumption: Levels and Patterns, 2018) to 9.1 L of pure alcohol for those aged 15+ by 2020 (What is the Public Health (Alcohol) Act?, 2019), but this target is unlikely to be met. Renewed efforts are warranted to reduce the amount of alcohol consumption in the Irish population, but particularly among this vulnerable subgroup, as a high burden of AUD may compound other health-related inequalities when considering a more inclusive health picture of Irish MSM.

*Making Every Contact Count* (MECC) is a low-cost health promotion initiative whereby non-specialist staff from a wide array of healthcare backgrounds are trained in the delivery of brief interventions to encourage behaviour change among patients (Nelson et al., 2013). Brief interventions may be particularly important in reducing alcohol consumption, since two-thirds of Irish people with hazardous patterns of alcohol consumption classify themselves as light/moderate drinkers (Mongan et al., 2020).

These population-based approaches to reducing alcohol consumption may be complemented by more targeted interventions for MSM. Our findings suggest that MSM may benefit from targeted preventive messaging in collaboration with key LGBT + community and health service partners. Finally, given the high prevalence of illicit drug use among those who reported potential AUD, there is a need for integrated prevention interventions across the spectrum of substance use for MSM (Barrett et al., 2019).

#### 5. Conclusion

MSM in Ireland report high levels of potential AUD. This was particularly observed in MSM who were unemployed, identified as bisexual, used illicit drugs, had been victimised by homophobic abuse, or who screened positive for anxiety/depression. Targeted interventions may be warranted to decrease the prevalence of AUD in this population.

#### Contributors

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FPD performed the analyses and wrote the article under the supervision of PB.

All authors have read and approved the final manuscript.

#### Role of funding source

EMIS-2017 occurred as part of ESTICOM (European Surveys and Training to Improve MSM Community Health), a 3-year project funded by the European Commission Health Programme 2014–2020 through a tender commissioned by the Consumers, Health, Agriculture and Food Executive Agency (CHAFEA) to deliver evidence about the sexual health of gay men, bisexual men and other MSM across Europe. For this study, there is no funding source to declare.

#### Declaration of Competing Interest

The authors report no declarations of competing interest.

#### Acknowledgements

We would like to sincerely thank all the men who gave their time to participate in EMIS-2017. We would also like to thank the co-ordinators of the overall EMIS-2017 survey for their invaluable knowledge and patience. Lastly, we would like to credit all of the Irish partners that aided in the study design and recruitment, including Gay Health Network, Man2Man, HIV Ireland, Outhouse, Gender, Orientation, Sexual Health and HIV, Sexual Health Centre, Cork, AIDS West, Gay Community News, Health Service Executive, Gay Men's Health Service, Sexual Health and Crisis Pregnancy Programme, Health Protection Surveillance Centre, and Mick Quinlan. EMIS-2017 was co-ordinated by Sigma Research at the London School of Hygiene and Tropical Medicine (LSHTM) in association with the Robert Koch Institute (RKI) in Berlin.

EMIS core team at Sigma Research (LSHTM): Ford Hickson, David Reid, Axel J. Schmidt, and Peter Weatherburn.

#### 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.2021.108698>.

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