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Alcohol dependence and heavy episodic drinking are associated with different levels of risk of death or repeat emergency service attendance after a suicide attempt

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Title: **Alcohol dependence and heavy episodic drinking are associated with different levels of risk of death or repeat emergency service attendance after a suicide attempt***

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Highlights

- **Latent Class Analysis found 3 distinct classes of alcohol users in suicidal crisis**
- **Dependent drinkers' odds of death/repeat crisis >2-fold that of low risk drinkers**
- **The lowest odds of death/repeat crisis were found among heavy episodic drinkers**
- **Post-crisis care pathways should not take a 'one size fits all' view of alcohol use**

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Data availability:

JER, NJK, KIM, RDH, MP, and VC had access to the study data during the period of data analysis. The ethical approval to access CRIS data (Oxfordshire Research Ethics Committee C (18/SC/0372)) requires the data to be stored behind an NHS firewall with access governed by a patient-led oversight committee. For this reason, the data cannot be made available in the manuscript, Supporting Information files or a public repository. However, subject to approval from the oversight committee, data access for research purposes is encouraged. Further information is available from cris.administrator@slam.nhs.uk.

Abstract

Background

Alcohol use is a multidimensional risk factor for suicidal behaviour. However, suicide prevention strategies often take 'one-size-fits-all' approaches to alcohol use, reflecting an evidence base built on unidimensional measures. Latent Class Analysis can use a range of measures to differentiate distinct patterns of alcohol using behaviour and their associated risks.

Methods

We analysed Electronic Health Record data from 650 suicidal adults detained for up to 36 hours using police powers (Section 136 of the Mental Health Act 1983, amended 2007) to facilitate psychiatric assessment at a Health-Based Place of Safety, a dedicated emergency psychiatric care centre in London, UK. We conducted a Latent Class Analysis of alcohol using behaviours at first detention, and used multivariable logistic regression to estimate the association of each identified latent class with subsequent death or recontact with emergency psychiatric care over a median follow-up of 490 days, adjusting for sex, age and past-year psychiatric diagnosis.

Results

Three classes of alcohol use were identified: low risk drinkers, heavy episodic drinkers and dependent drinkers. The dependent drinking class had twice the odds of death or recontact with emergency psychiatric care as the low risk drinking class (OR 2.32, 95%CI 1.62-3.32, $p < 0.001$). Conversely, the heavy episodic drinking class was associated with lower odds of death or recontact than the low risk drinking class (OR 0.66, 95%CI 0.53-0.81, $p < 0.001$).

Conclusions

The risk of adverse outcomes after a suicide attempt are not uniform for different alcohol use classes. Clinical assessment and suicide prevention efforts should be tailored accordingly.

Keywords: Alcohol, Suicide, Mental Health Act, Emergency Psychiatric Care, Section 136, Latent Class Analysis

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1. Introduction

Alcohol is a risk factor for suicide and suicide attempts, with 22% of global suicides attributed to its consumption (WHO, 2014). Despite the pervasiveness of alcohol use, suicide prevention policies often fail to address this modifiable risk factor (Kalk et al., 2019). Where it is addressed this is often through a 'one-size-fits-all' recommendation that belies the broad spectrum of Alcohol Use Disorder (AUD) severity, either assuming that everyone targeted is dependent thus requiring secondary addiction services (e.g. Department of Health, 2017) or that the problems are mild and responsive to brief intervention (e.g. Healthy London Partnership, 2017).

Underlying these policy deficits is an evidence base that likewise takes a simplistic approach to the complexity of alcohol use. Most studies considering the association between alcohol use and suicidal behaviour use a single variable indicating presence or absence of elements such as intoxication or an AUD; e.g. AUD indicated by ICD-10 diagnostic code (Bowden et al., 2018; Edwards et al., 2020), or acute consumption indicated by self-report or Blood Alcohol Concentration (Bagge and Borges, 2017; Lee et al., 2017). Such studies fail to capture the full spectrum of alcohol using behaviour. Other studies use vague constructs, e.g. 'alcohol problem' or 'misuse of alcohol', predicated on clinician judgement (Haw et al., 2007; Ness et al., 2015). Even where definitions of constructs are more precise – such as 'alcohol misuse' defined as weekly consumption of alcohol greater than 21 units for men and 14 units for women (Hawton et al., 2015) – there is still a failure to capture the spectrum of severity that may require different interventions. There is thus a lack of evidence to define the optimal clinical pathways for treating alcohol related suicidality.

Emergency psychiatry makes provisions for the intoxicated (Healthy London Partnership, 2017), but pathways that reliably identify and support those whose alcohol use pattern puts them at increased risk of adverse outcomes after suicidal crisis are less well established. Previous research has

identified the paradox of alcohol use being associated with less intensive interventions following a suicide attempt (Urban et al., 2018), despite AUD being associated with subsequent increased risk of suicide (Bowden et al., 2018) and repeat emergency attendance (Kapur et al., 2006). Research by the current authors found this disparity exists even after controlling for resolution of suicidality when intoxication subsides (Robins et al., 2021).

In this paper we use a range of alcohol-related indicators to identify different profiles of alcohol use and investigate whether these profiles have distinct associations with post-crisis mortality and repeat emergency care.

1.1 Current study

We hypothesised that there are distinct profiles of alcohol use among individuals in suicidal crisis, and these distinct groups would be associated with different levels of subsequent mortality or recontact with emergency psychiatric care. We used pseudonymised Electronic Health Record (EHR) data from patients assessed in a dedicated emergency psychiatric assessment unit, to conduct a Latent Class Analysis (LCA) of suicidal detainees. Five variables were used to build the Latent Class model; question 3 from the Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2001), Blood Alcohol Concentration, provision of detoxification medication, and past year ICD-10 diagnoses of harmful drinking or alcohol dependence (WHO, 2016). We estimated the association of each profile type with the composite outcome of all-cause mortality or a recontact with emergency psychiatric care in a median 490 days follow-up.

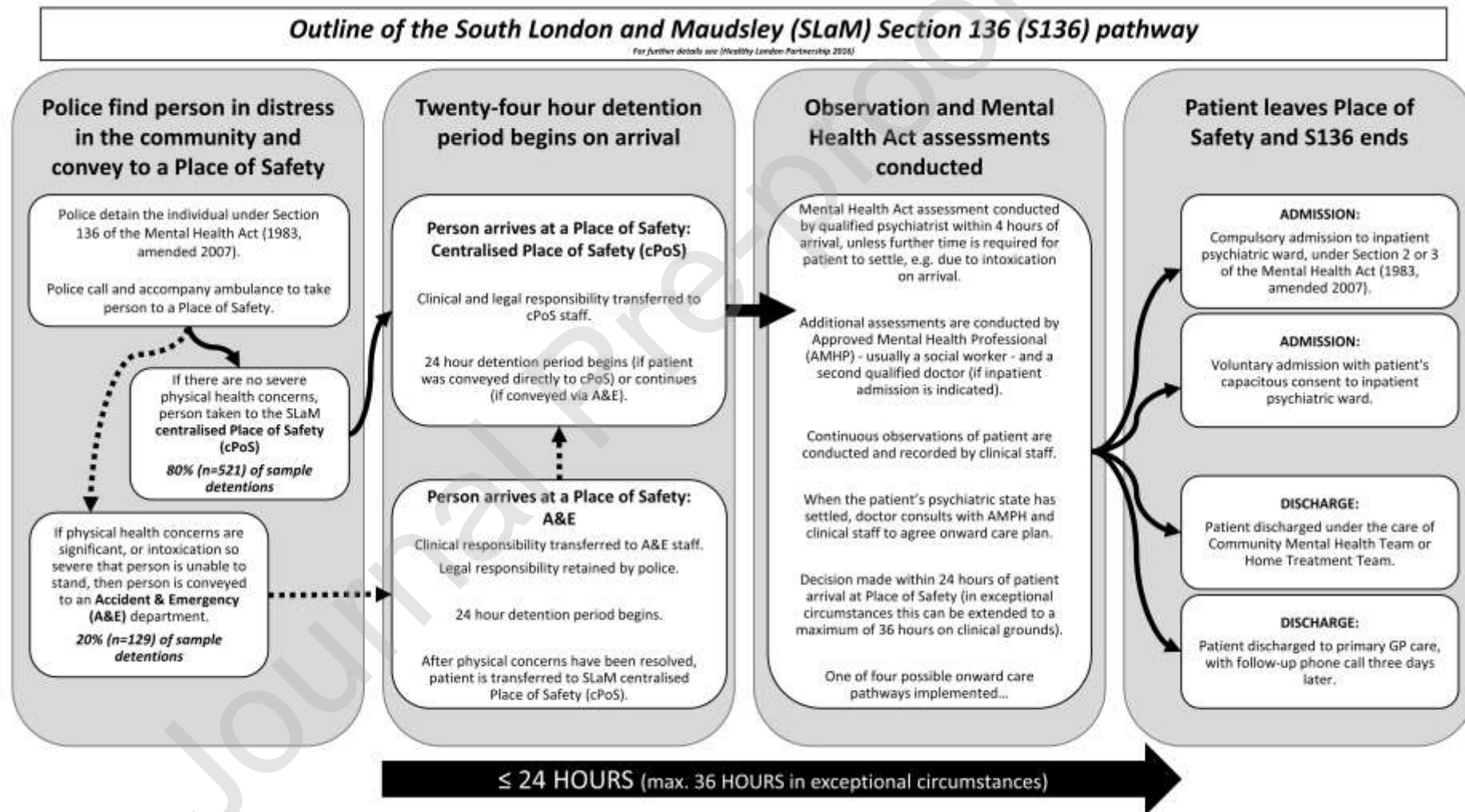


Figure 1 (Page Error! Bookmark not defined.):

South London and Maudsley (SLaM) NHS Foundation Trust care pathway for people detained under Section 136 of the Mental Health Act 1983 (amended 2007).

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2. Methods

2.1 Design and setting

In England and Wales, police use Section 136 (s136) of the Mental Health Act (MHA) (1983, amended 2007) to detain people in psychiatric crisis who are 'in immediate need of care or control' and take them to a 'Place of Safety' for emergency psychiatric assessment (Her Majesty's Government, 1983, p104). Up to 80% of s136 detentions relate to suicidal behaviour (Bendelow et al., 2019). We used EHR data from suicidal individuals detained under s136 at the South London and Maudsley (SLaM) Centralised Place of Safety (cPoS), a purpose-built Health-Based Place of Safety with a dedicated team (Healthy London Partnership, 2017). The maximum duration of detention is 36 hours (see Figure 1 for details).

2.2 Participants

All individuals aged 18 and over who were detained between 1st February 2017 and 4th October 2018 were eligible for inclusion. Individuals were excluded if they were not detained due to suicidal behaviour, or under s136 of the MHA (a minority of cPoS detentions are under Section 135, a distinct section of the MHA involving the removal of a person from a private dwelling after approval of a court magistrate, representing a qualitatively distinct population). Individuals were also excluded if they had a past-year primary diagnosis of Learning Disability, Neurodevelopmental Disorder or Organic Disorder as these individuals are rarely detained in the cPoS and have distinct needs and care pathways. Further exclusions were individuals transferred out of a SLaM borough, and repeat detentions of the same individual. See Figure 2 for flowchart.

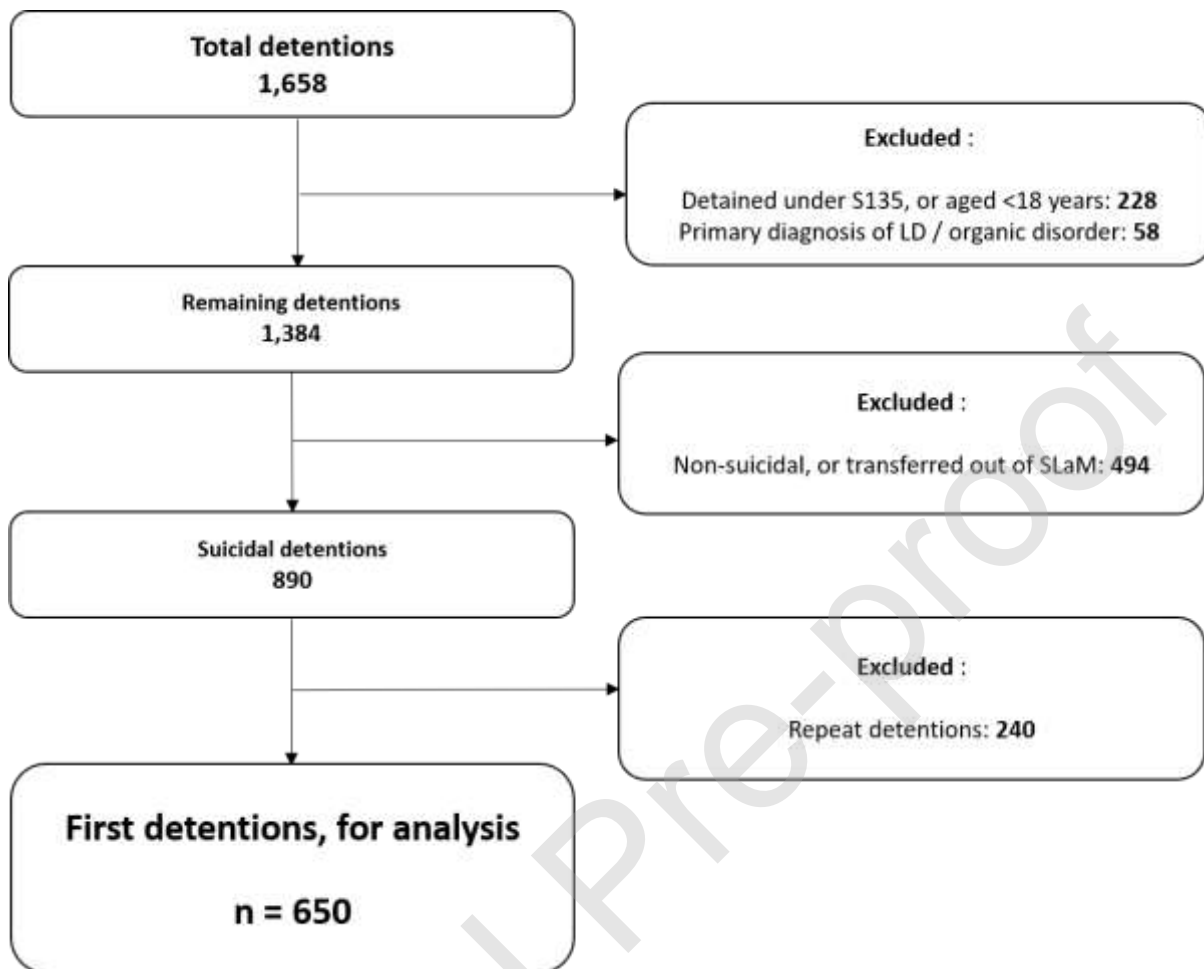


Figure 2 (Page Error! Bookmark not defined.) :

Application of exclusion criteria to cPoS patient detentions between 1st February 2017 and 4th October 2018. S135 detentions indicates detention under Section 135 of the Mental Health Act (1983, amended 2007); LD indicates learning disability diagnosis. Some exclusion criteria combined to avoid reporting counts <10

2.3 Data sources

The EHR data used were drawn from information recorded on the SLaM electronic Patient Journey System (ePJS) by clinicians working in the SLaM cPoS, specifically psychiatrists, nurses and approved mental health professionals. The SLaM NHS Foundation Trust Biomedical Research Centre Clinical Record Interactive Search (CRIS) application¹ was used to extract anonymised data from structured and unstructured text fields. Previously-developed CRIS-specific Natural Language Processing (NLP) algorithms were used to extract information on diagnoses and prescribed medications from the unstructured text fields. Manual review of the unstructured text fields was used to extract information pertaining to demographic characteristics, suicidal behaviour and intent, and substance use, including alcohol. A subset of unstructured text was re-scored by consultant psychiatrist(NJK) to estimate interrater reliability; Cohen's kappa differed by variable but estimates were generally strong, ranging from 0.72 to 0.94. Database queries and data extraction, processing and entry were implemented in R software (v3.5.1) (R Core Team, 2016).

2.4 Ethical approval

Ethical approval was granted via the Oxford C Research Ethics Committee, reference (18/SC/0372) which covers all uses of CRIS as an anonymised database for secondary analysis (Perera et al., 2016). CRIS oversight committee approval was granted under project numbers 17-104 and 1413. All patient identifiable information was removed prior to use by the CRIS application, including patient names, family or friends' names, and relevant location information. All data remained within the NHS firewall during analysis.

¹ The design, operation and development of the SLaM NHS Foundation Trust Biomedical Research Centre Clinical Record Interactive Search (CRIS) application has been described extensively elsewhere, see (Perera et al., 2016) for further details.

2.5 Measures

A table of all measures extracted via CRIS for inclusion in this study, including field derivation, is in Supplementary Table S1².

2.5.1 Cohort definition measure: Suicidality

Individuals were deemed suicidal if they had attempted suicide or expressed suicidal thoughts or intent prior to detention (and hence was the reason for detention). There are currently no structured EHR fields used in cPoS which capture presenting circumstances prior to detention, but this information is routinely recorded in the unstructured text fields. Unstructured fields were screened to identify reported suicidal thoughts and/or suicidal acts associated with detention. Initial suicidality was scored “Yes” if police or clinical staff reported suicidal thoughts or acts precipitating detention; “Possible” if the patient’s reported actions could be interpreted as suicidal but intent was not clear, such as walking into traffic; and “No” if no suicidal thoughts or acts were reported. For analysis purposes, only detentions in the “Yes” category were included.

2.5.2 Exposure / LCA indicator variables: Alcohol use

Various indicators of alcohol using behaviour were recorded (complete list in Supplementary Table S2)³. In order to build a parsimonious model, we examined pairwise correlations of all alcohol-related exposure variables. Where two indicators were highly correlated with each other (>0.8), one was discarded, with the more objective indicator preferentially retained (see Supplementary Table S3 for correlation matrix)⁴. Consequently, five measures of alcohol use were included in the LCA:

- AUDIT-3 score as a measure of heavy episodic drinking (HED)⁵. The Alcohol Use and Disorders Identification Test (AUDIT) is a ten-item self-reported measure of hazardous and

² Supplementary material can be found by accessing the online version of this paper at <https://dx.doi.org/> and by entering doi:

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⁵ In the present study we have used the term ‘Heavy Episodic Drinking’ (HED), which is often synonymous with ‘binge drinking’ (Kuntsche et al., 2017). As definitions of HED and binge drinking are inconsistently defined (Gmel et al., 2011), we have opted to use the former to

harmful alcohol use in the past year (Babor et al., 2001), item 3 of which pertains specifically to frequency of heavy drinking (i.e. “How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?”). The AUDIT-3 variable was derived from the component AUDIT score variable related to question 3 of the AUDIT; responses were dichotomised so a score of 2 or 3 (“Monthly” or “Weekly”) indicated heavy episodic (i.e. regular risky single-occasion) drinking, whereas 0, 1 or 4 (“Never” / “Less than monthly” / “Daily or almost daily”) indicated a pattern outside these parameters. The inclusion of AUDIT-3 as a distinct variable precluded the use of the full AUDIT as to use both in the LCA would have violated assumptions of local independence (Collins and Lanza, 2009). However, using the single item AUDIT-3 provided a specific indicator of HED which has been validated in previous research (Kim and Hendershot, 2020), and may outperform the full AUDIT in detecting HED (Matano et al., 2003).

- Peak Blood Alcohol Concentration (BAC); measured by clinicians breathalysing detainees after arrival at the cPoS, providing an objective indicator of acute alcohol consumption. Eighty mg/dL is a standard cut-off to dichotomise BAC, with readings >80mg/dL representing some degree of intoxication (Macdonald et al., 2006).
- Provision of detoxification medication (benzodiazepines) during detention; a measure of physiological dependence.
- Past-year ICD-10 F10 diagnosis⁶, of *acute intoxication* (F10.0) or *harmful use of alcohol* (F10.1); a clinician-assessed measure of hazardous or harmful drinking patterns, with lower severity than alcohol dependence. Collapsed into a single variable; *Harmful use of alcohol diagnosis*, representing the presence of a drinking pattern disordered enough to warrant the designation of diagnostic code, but subordinate to alcohol dependence.

emphasise a harmful pattern of alcohol use whereby harm is derived from the amount consumed on a single occasion, rather than the chronicity of consumption (Dawson et al., 2008). Due to the variation in definition of these terms across studies, comparisons should be made with caution.

⁶ *Mental and behavioural disorders due to use of alcohol* (World Health Organization, 2016)

- Past-year ICD-10 diagnosis of *alcohol dependence syndrome* (F10.2) or related complications (F10.3-7)⁷, a clinician-assessed measure of alcohol dependence. Collapsed into a single variable; *Alcohol dependence diagnosis*.

Whilst BAC and the provision of detox medication are clearly measures of acute clinical presentation, the AUDIT-3 and ICD-10 indicator variables measure a timeframe up to a year prior to assessment. However, all these measures are tools that clinicians refer to and report when assessing current presenting risk and their inclusion is warranted for a clinically useful model.

In cases where an AUDIT-3 score or diagnostic code was not recorded during cPoS detention, the most recent instance prior to detention was used, if available and dated within one year prior to the current detention.

The measures of alcohol use excluded from the LCA were scores from the full ten-item AUDIT; alcohol withdrawal measured by Clinical Institute Withdrawal Assessment for Alcohol Scale (CIWA-A) score (Sullivan et al., 1989); and acute alcohol use indicated in the clinical notes written during cPoS detention. However, these measures are included in the sample description below (see Table 1).

2.5.3 Outcomes

2.5.3.1 Longitudinal outcome: Mortality and repeat use of emergency care

For the longitudinal analysis the outcomes of interest were all-cause mortality, and any recontact with SLaM emergency psychiatric care (EPC). All-cause mortality was chosen rather than suicide-specific mortality as CRIS does not routinely provide causes of deaths. Although obtaining cause-specific mortality information was theoretically feasible, the sample size and relatively small number of deaths meant that reporting cause-specific information would potentially violate reporting

⁷ F10.8 and F10.9 categories (which denote 'other' or 'unspecified' mental or behavioural disorders due to use of alcohol) were excluded from the analysis due to their lack of specificity.

restrictions for these data, designed to minimise risk of de-anonymisation. Given that the mean age of those detained under s136 of the MHA is between 32 and 41 (Borschmann et al., 2010), any death in the cohort can be considered premature. Recontact with SLaM EPC was considered to be evidence of contact with either the cPoS or the Liaison Psychiatry Teams, as the latter assess individuals who attend acute hospital emergency departments in psychiatric crisis. Both mortality status and recontact with EPC were derived from structured fields. Due to death being a rare event, mortality and recontact variables were collapsed into a composite endpoint, *Death or Recontact*, for statistical power. The follow-up period for everyone was defined as the period from their first detention, until either their death or a recontact event with SLaM EPC, or the end of the study on 24th January 2020, whichever came first. Twenty months and four days of detentions were included, with a median follow-up time of 490 days, over a total 771.7 person-years of follow-up.

2.5.4 Other variables

Other variables of interest were recorded, specifically sex, age, ethnicity, housing status, recent drug use other than alcohol (derived from both self-report and Urine Drug Screen), past-year ICD-10 Substance Use Disorder diagnosis, and past-year ICD-10 psychiatric disorder diagnosis (see Supplementary Table S1 for further details)⁸.

2.6 Analysis

All analyses undertaken in R version 3.6.1 (R Core Team, 2016).

Sample characteristics were described using frequencies, percentages, means and standard deviations as appropriate, and chi-square or t-tests for significance.

⁸ Supplementary material can be found by accessing the online version of this paper at <https://dx.doi.org/> and by entering doi:

2.6.1 Latent Class Analysis

LCA allows distinct patterns to be identified from a complex array of data. That is, LCA identifies subgroups of individuals within a sample which exhibit similar patterns of individual characteristics - in this case related to alcohol-use behaviour – and which may not be discernible by considering the constituent indicator variables alone (Collins and Lanza, 2009). The clinical utility of LCA is exemplified by a 2012 study which identified six latent classes of eating disorder, and found these classes to better predict mortality than the then-current classifications listed in the DSM-IV (Crow et al., 2012). LCA has been used previously in addiction research to characterise substance use patterns and their relationship with risk behaviours and clinical outcomes (Boniface et al., 2020; Jackson et al., 2014; Morley et al., 2015).

The LCA model provides *latent class membership probabilities* - i.e. estimates of the proportion of the sample in each latent class, and *item-response probabilities* - estimates of the probability of a particular response to each indicator variable within each latent class. Using the poLCA package in R (Linzer and Lewis, 2011), we fit the model with an increasing number of classes and compared the results. Fit statistics (AIC and BIC) were used to assist in selecting the most parsimonious model, with clinical relevance and ease of interpretability also informing the final model choice (Lanza et al., 2013, 2012).

2.6.2 Latent Class Regression

Latent Class Regression (LCR) was used to model the association of each identified class with the presence of an adverse longitudinal outcome, i.e. death or recontact with SLaM EPC. The case-weight approach to LCR was used, which uses posterior class probabilities as weighting variables to account for class classification uncertainty (Kamata et al., 2018). Age, sex and psychiatric diagnosis were included as covariates, with the latter collapsed into a binary variable.

3. Results

3.1 Sample characteristics

Six-hundred and fifty unique individuals were detained during the study period. 392 (60.3%) of the sample were detained having used alcohol prior to detention. Among the 491 individuals who had a completed AUDIT, 121 (18.6% of sample) had a score >20 indicating possible dependence. The mean age was 34.8 years (SD=11.5) and fewer than five detainees were above the age of 65. The sample contained a greater proportion of males (n=384, 59.1%) than females. Descriptive statistics are tabulated in Table 1.

The observation period ran from 1st February 2017 to 24th January 2020, comprising a total of 771.7 person-years. Median follow-up period was 490 days. In unadjusted analyses, ethnicity, housing status, AUDIT risk category (derived from 10-item AUDIT), HED (from Q3 of AUDIT), provision of detox medication and past-year psychiatric diagnosis were all significantly associated with an adverse longitudinal outcome (death, or recontact with SLaM EPC). Adverse outcomes were observed in 365 individuals; 348 (53.5%) had at least one recontact event, and 32 (4.9%) died. Of those that died, 23 (71.9%) were male, and 10 (31.2%) had a psychotic disorder diagnosis.

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Variable	Categories	Total detentions		Death or Recontact with SLAM EPC				p value
		N	%	No		Yes		
				N	%	N	%	
Age in years	<i>Continuous (range 18 – 70)</i>	650	100	t(648)=0.835				0.404
Sex	Male	384	59.1	176	61.8	208	57	0.252
	Female	266	40.9	109	38.2	157	43	
Ethnicity	White	419	64.5	174	61.1	245	67.1	<0.001
	Black	112	17.2	43	15.1	69	18.9	
	Asian	25	3.8	13	4.6	12	3.3	
	Mixed	10	1.5	*	*	*	*	
	Other	19	2.9	*	*	14	3.8	
	<i>Missing</i>	65	10	46	16.1	19	5.2	
Housing status	Permanent	389	59.8	183	64.2	206	56.4	0.032
	Homeless	108	16.6	41	14.4	67	18.4	
	Supported	76	11.7	25	8.8	51	14	
	Temporary	30	4.6	17	6	13	3.6	
	<i>Missing</i>	47	7.2	19	6.7	28	7.7	
Acute Alcohol Use	Yes	392	60.3	178	62.5	214	58.6	0.693
	No	194	29.8	84	29.5	110	30.1	
	<i>Missing</i>	64	9.8	23	8.1	41	11.2	
AUDIT risk category	Lower risk	265	40.8	115	40.4	150	41.1	0.049
	Hazardous/increasing risk	80	12.3	46	16.1	34	9.3	
	Harmful/higher risk	25	3.8	10	3.5	15	4.1	
	Possible/dependence	121	18.6	46	16.1	75	20.5	
	<i>Missing</i>	159	24.5	68	23.9	91	24.9	
AUDIT heavy episodic drinking	No	303	46.6	122	42.8	181	49.6	0.033
	Yes	188	28.9	95	33.3	93	25.5	
	<i>Missing</i>	159	24.5	68	23.9	91	24.9	

REVISED FOR DRUG AND ALCOHOL DEPENDENCE RESUBMISSION

Variable	Categories	Total detentions		Death or Recontact with SLaM EPC				p value
Detox medication given	No	601	92.5	271	95.1	330	90.4	0.037
	Yes	49	7.5	14	4.9	35	9.6	
Blood Alcohol Content	<80mg/L	441	67.8	190	66.7	251	68.8	0.628
	80mg/L +	209	32.2	95	33.3	114	31.2	
CIWA score	Nil (0)	530	81.5	236	82.8	294	80.5	0.616
	Mild (1-10)	62	9.5	28	9.8	34	9.3	
	Moderate (11-15)	22	3.4	*	*	15	4.1	
	Severe (>15)	36	5.5	14	4.9	22	6	
Harmful use of alcohol diagnosis	No	538	82.8	228	80	310	84.9	0.122
	Yes	112	17.2	57	20	55	15.1	
Alcohol dependence diagnosis	No	585	90	260	91.2	325	89	0.429
	Yes	65	10	25	8.8	40	11	
Acute other drug use	No	336	51.7	155	54.4	181	49.6	0.473
	Yes	250	38.5	107	37.5	143	39.2	
	Missing	64	9.8	23	8.1	41	11.2	
Psychiatric diagnosis	Personality Disorder	145	22.3	40	14	105	28.8	<0.001
	Psychotic disorder	156	24	45	15.8	111	30.4	
	Depressive disorder / anxiety	121	18.6	73	25.6	48	13.2	
	Unspecified MH disorder	54	8.3	27	9.5	27	7.4	
	No MH diagnosis	174	26.8	100	35.1	74	20.3	
Substance Use Disorder diagnosis	No	528	81.2	237	83.2	291	79.7	0.060
	Yes	79	12.2	26	9.1	53	14.5	
	Missing	43	6.6	22	7.7	21	5.8	

Table 1: Descriptive statistics for complete sample of individuals (n=650); displayed as number (N) and percentage (%) and stratified by Death or Recontact with SLaM emergency psychiatric care (EPC). P-values derived from chi-squared tests or t-tests as appropriate.

AUDIT = Alcohol Use Disorder Identification Test (Babor et al., 2001)

AUDIT heavy episodic drinking = Question 3 of AUDIT, i.e. "How often have you had 6 or more units if female, or 8 or more if male, on a single occasion in the last year?"

CIWA = Clinical Institute Withdrawal Assessment for alcohol scale (Sullivan et al., 1989)

Harmful use of alcohol diagnosis = ICD-10 F10.0 or F10.1 diagnosis in past year (World Health Organization, 2016)

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Alcohol dependence diagnosis = ICD-10 F10.2-10.7 diagnosis in past year

Personality disorder = ICD-10 F61 – F63, F68, F69 diagnosis in past year

Psychotic disorder = ICD-10 F20-F23, F25, F28, F29, F30, F31 diagnosis in past year

Depressive disorder / Anxiety = ICD-10 F32, F33, F34, F38, F39, F40 – F45 diagnosis in past year

** Cell counts <10 suppressed to prevent risk of de-anonymisation*

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3.2 Latent Class Analysis

Models with up to nine class solutions were fitted to the data. Solutions with 5 or more classes remained unidentified after 5000 estimations and were thus abandoned. The AIC and BIC fit statistics indicated the three-class solution as most parsimonious (see Table 2 below). See Supplementary Figure S4⁹ for identity plot of log-likelihood values for each LCA model attempted.

The three-class model was easily interpretable, with item-response probabilities representing “Low alcohol use” (class-membership probability 0.57), “Heavy episodic drinkers” (0.28) and “Dependent drinkers” (0.15). See Table 3 and Figure 3 below. Class 1 is characterised by uniformly low item-response probabilities. Class 2 is defined by high probability of an AUDIT-3 HED score (0.77) and BAC \geq 80mg/dL (0.73), but low probability of the dependency indicators – detox medication provision (0.05) and ICD-10 dependency diagnosis (0.05). Class 3 is distinguished by higher probability of the dependency indicators (0.37 and 0.49 respectively), the highest BAC \geq 80mg/dL probability (0.78) and the lowest probability of an AUDIT-3 HED score (0.08). The latter would be expected as dependent drinkers would presumably answer “Daily or almost daily” to the AUDIT-3, thus placing themselves outside of the boundaries of heavy episodic drinking behaviour represented by responses “Monthly” or “Weekly”.

The distribution of clinical and demographic variables across predicted class membership is provided in Supplementary Tables S5 and S6¹⁰.

<i>Class</i>	<i>Log-likelihood</i>	<i>Bayesian information criterion (BIC)</i>	<i>Akaike information criterion (AIC)</i>
1	-1418.73	2869.846	2847.462
2	-1326.34	2723.924	2674.677
3	-1303.32	2716.748	2640.639
4	-1299.34	2747.646	2644.676

Table 2: Fit statistics for Latent Class model with 1, 2, 3 and 4 latent classes.

⁹ Supplementary material can be found by accessing the online version of this paper at <https://dx.doi.org/> and by entering doi:

¹⁰ Supplementary material can be found by accessing the online version of this paper at <https://dx.doi.org/> and by entering doi:

Category	Class1: Low alcohol	Class2: Heavy episodic drinkers	Class3: Dependent drinkers
Class membership	0.57	0.28	0.15
<i>HED</i>	0.27	0.77	0.08
<i>BAC</i>	0.00	0.73	0.78
<i>Detox</i>	0.01	0.05	0.37
<i>Harmful</i>	0.02	0.39	0.34
<i>Dependence</i>	0.02	0.05	0.49

Table 3: Class membership probabilities and item-response probabilities for 3 class solution.

HED = Response of 'Weekly' or 'Monthly' to Q3 of AUDIT

BAC = Blood Alcohol Concentration ≥ 80 mg/dl

Detox = Given chlordiazepoxide or another detox medication

Harmful = ICD-10 F10.0 or F10.1 diagnosis

Dependence = ICD-10 F10.2 - F10.7 diagnosis

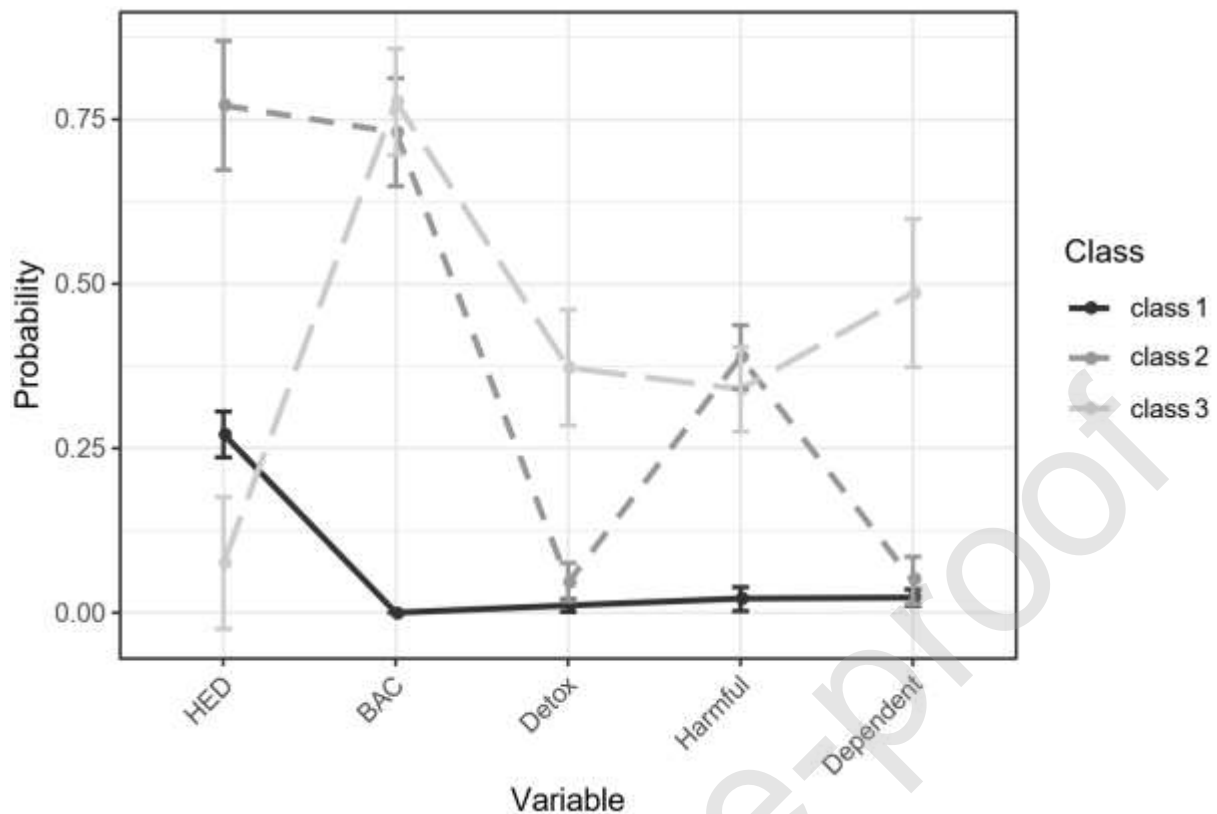


Figure 3 (Page Error! Bookmark not defined.):

Item response probabilities for 3 class solution

Class 1 = No / Low drinkers Class 2 = Heavy episodic drinkers Class 3 = Dependent drinkers

3.3 Latent Class Regression: Death or Recontact with crisis care

The case-weighted regression model used a composite adverse longitudinal outcome variable, comprising all-cause mortality or recontact with SLaM EPC, and was adjusted for the covariates age, sex and past-year psychiatric disorder diagnosis. The comparator for the latent class variable was the low-risk drinking class. Both Class 2 (heavy episodic drinkers) and Class 3 (dependent drinkers) were significantly associated with death or a recontact with EPC, but in opposite directions. Compared to low-risk drinkers, odds of the outcome increased for the dependent drinker class (AOR 2.32, 95%CI 1.62–3.32, $p < 0.001$) but decreased for the heavy episodic drinker class (AOR 0.66, 95%CI 0.53–0.81, $p < 0.001$). Of the covariates, presence of a past-year psychiatric diagnosis was positively associated

with death or a recontact with EPC (AOR 2.16, 95%CI 1.78-2.64, $p < 0.001$). See Table 4 for adjusted odds ratios, 95% confidence intervals and p-values for each latent class and all covariates.

Outcome: Death or recontact with SLaM Emergency Psychiatric Care				
	Adjusted Odds Ratio ^a	LCI (AOR)	UCI (AOR)	p
Class1: Low alcohol	(Ref.)			
Class2: Heavy episodic drinkers	0.66	0.53	0.81	<0.001
Class3: Dependent drinkers	2.32	1.62	3.32	<0.001
Sex: Female	1.16	0.96	1.41	0.127
Age	1.00	1.00	1.01	0.281
Psychiatric Diagnosis	2.16	1.78	2.64	<0.001

TABLE 4: Case-Weight regression model, using 3 class LCA conducted on 650 first detentions

Outcome: Death, or recontact with SLaM emergency psychiatric care

Class 1: No/low drinkers (ref category)

Class 2: Heavy episodic drinkers

Class 3: Dependent drinkers

Psychiatric diagnosis: Presence of any psychiatric disorder diagnosis (Depression / Anxiety / Psychotic disorders / Personality disorder)

^a Adjusted for sex, age and psychiatric diagnosis

4. Discussion

4.1. Summary of findings

Of the 650 individuals who attended the cPoS, 4.9% died after a median of 239.5 days, and 53.5% came back to SLAM EPC after a median 39.5 days. Alcohol dependence was associated with over 2-fold increased risk of death or re-presentation to EPC. Conversely, heavy episodic drinkers appeared to be the lowest risk group, with odds of death or re-presentation 34% lower than that of the low-risk drinkers.

The increased risk observed in the dependent drinking class is supported by non-LCA studies showing increased risk of repeated suicide attempt in individuals with AUD (Parra-Urbe et al., 2017). However, the evidence regarding post-crisis outcomes for heavy episodic drinkers is sparse. Our finding regarding heavy episodic drinkers seems surprising in the light of evidence that any acute consumption of alcohol confers an increased risk of suicide attempt (Borges et al., 2017). It is, however, concordant with our clinical experience that detention under s136 can prove a sobering experience to those who have developed acute suicidality while heavily intoxicated but without a co-existing chronic alcohol dependence. We have previously shown that suicidal intent resolves in a greater proportion of those who are intoxicated on detention following a suicidal act (Robins et al., 2021). However, this analysis did not examine how latent classes of alcohol use influenced this resolution, and this requires further investigation.

Distinct comorbidity and demographic patterns may constellate within each class and may provide insight. Previous studies using general population samples found that binge drinking is associated with past-year suicide attempt in females but not in males (Glasheen et al., 2015; Wilsnack et al., 2017), and not in either sex when there is comorbid depression (Kittel et al., 2019). The characteristics of our sample cohere with these findings; those with predicted HED class

membership were majority male (57.7%) with a marginally higher proportion of personality disorder or depressive disorder diagnoses, and the lowest of psychotic disorder (13.7%) - a diagnosis associated with high rates of psychiatric relapse and re-hospitalisation (Addington et al., 2013). (Full tabulation in Supplementary Tables S5/S6). Further formal exploration of diagnostic subgroups within each latent class is warranted.

4.2 Strengths

A strength of this study is its use of detailed clinical information from a difficult-to-study group. The sample of 650 individuals encompassed all adults in suicidal crisis detained under s136 over 20-months, within the NHS trust which serves the largest proportion of the UK population (Perera et al., 2016). The only exceptions are those who would have remained in A&E for assessment because of physical health needs, or those with diagnoses of dementia or learning difficulties. This approach minimized sampling bias, and manual note review of unstructured EHR fields ensured the entirety of the sample had genuine suicidal intent.

Our use of LCA improves on studies which have used single variables to distinguish different drinking patterns, (e.g. Hawton et al., 2015). Our LCA uses five variables that are all measures of a single 'latent' construct - alcohol using behaviour – but were derived from diverse sources (i.e. self-report, clinician-judgement, and biological markers). Where LCA has been used previously to assess the alcohol use patterns associated with suicide risk, the studies have used much smaller sample sizes (Ginley and Bagge, 2017), or have still relied on single-source measures, e.g. AUDIT scores only (Smith and Shevlin, 2008).

4.3 Limitations

EHR data is not objective because clinicians prioritise certain information, and knowledge of what happened prior to clinical contact is dependent on information provided by police, ambulance staff, and the detained individuals themselves. A recent systematic review identified the historical under-reporting of alcohol-related diagnoses in secondary care and noted variability in the tools used to

form diagnoses, casting uncertainty on the reliability of ICD-codes (Roberts et al., 2019). However, our manual review of pseudonymised unstructured fields authored by a range of staff attenuates this issue.

The AUDIT-3 refers to past-year drinking behaviour and may not represent the drinking that precipitated the suicidal crisis and detention. However, the test-retest reliability of AUDIT items is high when tested across a range of time-spans (Reinert and Allen, 2007), and both AUDIT and previous ICD-10 diagnoses are tools that clinicians refer to and report when assessing current presenting risk.

As LCA is a probabilistic approach, a detainee's most-likely class membership should not be taken as a certainty. Despite the cohort consisting of 650 detainees, this was not enough to avoid collapsing the psychiatric diagnosis variable to a binary indicator for the regression, possibly resulting in residual confounding as described in 4.1. above. Likewise, all-cause mortality was combined with service-recontact into a single outcome as a larger sample size would be required to estimate the specific association of latent class membership with premature death.

4.4 Clinical implications

We show that alcohol use in suicidal crisis is not a binary construct – there are distinct groups of behaviour associated with different levels of ongoing risk that can be differentiated using an array of observable measures. Thus, conducting a thorough alcohol-use assessment is essential in crisis care. Current s136 guidance in London recommends brief alcohol interventions are undertaken, and signposting or referral to substance misuse services where indicated (Healthy London Partnership, 2017). Whilst brief interventions are a suitable response to heavy episodic drinkers, the approach is likely insufficient for dependent drinkers (Glass et al., 2015). Given that a reduction in suicidal behaviour can occur if alcohol dependent individuals enter specialist addictions treatment (Ilgen et

al., 2007), attention and additional support should be given to ensuring they access a level of treatment commensurate with their needs and risk.

4.5 Further research and conclusions

Individuals in suicidal crisis who have a heavy episodic drinking pattern appear to be at lower risk of death or re-presentation to emergency psychiatric services. However, those who are alcohol dependent are at increased risk of death or re-presentation. This study provides important information by identifying a higher risk group amongst those who are detained in suicidal crisis while in an intoxicated state. A crucial question is whether additional tailored support to facilitate engagement with addiction services, such as the Alcohol Assertive Outreach Team approach (Blackwood et al., 2020), could attenuate this risk.

Contributors

JER, NJK, KIM, RDH, MP, and VC were involved in the conception and design of the study. NJK, MP, and KIM designed the data extraction protocol. JER, NJK, KRR, and KIM scored clinical notes. JER and KIM conducted the data analysis. JER, NJK, KIM, and RDH drafted the manuscript, with input from all other authors. JER is the guarantor. All authors approved the final version of the article.

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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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RDH has received research funding from Roche, Pfizer, Janssen and Lundbeck.

NJK was supported by a NIHR Clinical Lectureship when part of this work was done and is a psychiatrist employed in the NHS. NJK has received PhD funding, research materials funding, and educational funds from GSK during her PhD (2010-2013).

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