Psychological Medicine

cambridge.org/psm

Substance use in psychiatric crisis: relationship to violence

Nicola J. Kalk[1,2], John E. Robins[1,2], Kezia R. Ross[2], Megan Pritchard[1,2], Michael T. Lynskey[2], Vivienne A. Curtis[1,2] and Katherine I. Morley[1,2,3,4]

[1]South London and Maudsley NHS Foundation Trust, London, UK; [2]Addictions Department, King's College London Institute of Psychiatry, Psychology and Neuroscience, London, UK; [3]Centre for Epidemiology and Biostatistics, Melbourne School of Global and Population Health, The University of Melbourne, Melbourne, Australia and [4]RAND Europe, Westbrook Centre, Cambridge, UK

Original Article

Cite this article: Kalk NJ, Robins JE, Ross KR, Pritchard M, Lynskey MT, Curtis VA, Morley KI (2022). Substance use in psychiatric crisis: relationship to violence. *Psychological Medicine* **52**, 1691–1697. https://doi.org/10.1017/S0033291720003451

Received: 2 July 2019
Revised: 2 September 2020
Accepted: 4 September 2020
First published online: 5 November 2020

Key words:
Aggression; cannabinoids; cannabis; emergency psychiatry; psychosis; stimulants; violence

Author for correspondence:
Nicola J. Kalk,
E-mail: nicola.kalk@kcl.ac.uk

Abstract

Background. Substance use and psychiatric illness, particularly psychotic disorders, contribute to violence in emergency healthcare settings. However, there is limited research regarding the relationship between specific substances, psychotic symptoms and violent behaviour in such settings. We investigated the interaction between recent cannabinoid and stimulant use, and acute psychotic symptoms, in relation to violent behaviour in a British emergency healthcare setting.

Methods. We used electronic medical records from detentions of 1089 individuals under Section 136 of the UK Mental Health Act (1983 amended 2007), an emergency police power used to detain people for 24–36 h for psychiatric assessment. The relationship between recent cannabinoids and/or stimulant use, psychotic symptoms, and violent behaviour, was estimated using logistic regression.

Findings. There was evidence of recent alcohol or drug use in 64.5% of detentions. Violent incidents occurred in 12.6% of detentions. Psychotic symptoms increased the odds of violence by 4.0 [95% confidence intervals (CI) 2.2–7.4; $p < 0.0001$]. Cannabinoid use combined with psychotic symptoms increased the odds of violence further [odds ratios (OR) 7.1, 95% CI 3.7–13.6; $p < 0.0001$]. Recent use of cannabinoids with stimulants but without psychotic symptoms was also associated with increased odds of violence (OR 3.3, 95% CI 1.4–7.9; $p < 0.0001$).

Interpretation. In the emergency setting, patients who have recently used cannabinoids and exhibit psychotic symptoms are at higher risk of violent behaviour. Those who have used both stimulants and cannabinoids without psychotic symptoms may also be at increased risk. De-escalation protocols in emergency healthcare settings should account explicitly for substance use.

Introduction

Violence is an increasing feature of emergency healthcare presentations (Nikathil et al., 2018) with a substantial negative impact on patient care and staff wellbeing. The association between illicit drug and alcohol use, mental health problems and violent behaviour in the emergency department is consistently reported by clinical staff (Pich, Kable, & Hazelton, 2017; Speroni, Fitch, Dawson, Dugan, & Atherton, 2014; Yalcin & Bilgin, 2019), but most patient-focused studies have been purely descriptive (Kaeser et al., 2018; Nikathil et al., 2018; Svoboda, 2014; Unadkat, Subasinghe, Harvey, & Castle, 2019; Wicomb, Jacobs, Ebrahim, Rensburg, & Macharia, 2018). Systematic reviews of in-patient psychiatric patient samples have demonstrated an increased risk of violence associated with schizophrenia, a history of illicit drug use and a history of alcohol misuse and violence (Cornaggia, Beghi, Pavone, & Barale, 2011; Dack, Ross, Papadopoulos, Stewart, & Bowers, 2013; Iozzino, Ferrari, Large, Nielssen, & de Girolamo, 2015). Community studies report that a lifetime diagnosis of schizophrenia is associated with a two-fold increased risk of violence while comorbid substance use increases the risk further to eight-fold (Fazel, Gulati, Linsell, Geddes, & Grann, 2009), although the interaction between the two is not well characterised. However, these studies have not distinguished between alcohol and different illicit substances. They have also not considered how acute substance use interacts with acute psychiatric symptomatology. The risk conferred by substance use in the emergency or acute psychiatric setting may be complicated by the propensity of illicit drugs such as cannabinoids and stimulants to precipitate psychosis (Lecomte, Dumais, Dugré, & Potvin, 2018; Marconi, Di Forti, Lewis, Murray, & Vassos, 2016), which also confers risk of violence (Fazel et al., 2009).

There is also little evidence regarding the risk of violence and specific substances. A recent meta-analysis of epidemiological data concluded there was a moderate association between both

CAMBRIDGE UNIVERSITY PRESS

cannabis use and cannabis misuse and violence in patients with a diagnosis of severe mental illness, but established that the field to date did not distinguish between chronic and acute use, or take into account use of alcohol or other drugs (Dellazizzo et al., 2019). In the emergency context, one study found that patients who had used synthetic cannabinoids with or without cannabis, or cannabis alone were more violent than those who had not used either (Bassir Nia, Medrano, Perkel, Galynker, & Hurd, 2016), while another found a 14-fold increased risk of violence prior to psychiatric admission in those who reported using novel psychoactive substances (Shafi, Gallagher, Stewart, Martinotti, & Corazza, 2017). Although high proportions of patients presenting to emergency departments with methamphetamine intoxication are reported to be violent (Unadkat et al., 2019), only one small study examined the relationship between methamphetamine and violence in acute psychiatric care and found no significant association (Vos, Cloete, Le Roux, Kidd, & Jordaan, 2010). Thus, data on substance-specific association with violence in emergency medical or psychiatric settings are limited. Additionally, the interaction between recent use of specific substances and acute psychotic symptoms has not been examined.

One clinical context in which risk factors for violence can be investigated in detail is psychiatric emergency services. Patients in this context have high levels of substance use, and thus represent a group in which some of the key risk factors for physical violence intersect (Zisman & O'Brien, 2015). International evidence regarding those detained by police using emergency powers to facilitate emergency psychiatric assessment indicates that they are frequently experiencing acute psychotic symptoms and have a high frequency of substance intoxication (Maharaj, Gillies, Andrew, & O'Brien, 2011; Zisman & O'Brien, 2015). They are also more likely to behave aggressively (Maharaj et al., 2011).

In the UK, there have been recent improvements in the pathway for people detained by under Section 136 of the Mental Health Act (1983 amended 2007), which is an emergency power allowing police to detain people they were believed to be suffering from a psychiatric disorder and in immediate need of care or control. Previously, such people would be taken to police cells, A&Es, or isolated '136 suites' often attached to psychiatric wards, and staffed ad hoc, for psychiatric assessment. Since 2016, Places of Safety, dedicated units for care and assessment of people detained under Section 136 with dedicated staffing, have been built. It is now recommended that patients are taken to a Place of Safety following detention under Section 136, and only to A&E if they require medical evaluation, for example, overdose (Healthy London Partnership, 2017). They should no longer be taken to police stations. People may be detained in a centralised Place of Safety (cPoS) for 24 h, potentially extended to a maximum of 36 h on clinical grounds, to facilitate emergency psychiatric assessment. The SLaM centralised Place of Safety is such a unit, covering four London boroughs with a population of around 1.3 million people as well as transport hubs and river crossings where suicide attempts are common. It receives between 80 and 100 people per month – providing a large sample enriched for both acute psychiatric presentations and acute substance use.

We investigated the relationship between acute psychotic symptoms, recent use of alcohol and illicit drugs, and physical violence using data from over 1000 individuals from the UK who were detained by police under Section 136 of the Mental Health Act (1983 amended 2007) to the South London and Maudsley cPoS. Using these data, we investigated specifically the hypothesis that recent use of cannabinoids and/or stimulants, or acute psychotic symptoms, would be associated with an increased risk of physical assault on other patients or staff, or damage to property (pre-registration of our analysis plan is available at DOI *https://osf.io/acpxr*). Further, we hypothesised that recent use of cannabinoids or stimulants in patients with acute psychotic symptoms would be associated with a higher risk of physical assault on other patients or staff, or damage to property.

Methods

Sample

We analysed data from detentions of individuals in the South London and Maudsley NHS Foundation Trust (SLaM) cPoS under Section 136 of the Mental Health Act (1983 amended 2007; MHA). Under the MHA individuals can be detained for 24 h, with a maximum extension to 48 h. The cPoS is a purpose-built clinical facility designed to replace four separate, local, Places of Safety and consequently provides care for a large number of detainees – between 80 and 100/month. All detentions of individuals aged 18 and over between the 1 February 2017 and the 4 October 2018 were eligible for inclusion in the study. Detentions of service users with a diagnosis of dementia or learning disability recorded during the detention or in the year prior were excluded as these individuals are very rarely detained in the cPoS and present a disparate risk profile. Similarly, those detained to the cPoS under Section 135 of the MHA (<10%) were excluded as these individuals are detained to the Place of Safety as part of the process of a planned MHA assessment and as such represent a distinct group.

Data were drawn from the pseudonymised electronic health record (EHR) collection of SLaM patient records that is available via the SLaM Biomedical Research Centre (BRC), Clinical Records Interactive Search system (CRIS), which is based on the electronic Patient Journal System used by SLaM clinical staff (Perera et al., 2016). We used information from structured forms and unstructured text notes – that is, free text notes entries – completed by clinical staff (See Supplementary Material Section 1.1 for more detail).

Information from unstructured fields was extracted using natural language processing (NLP) algorithms and manual review. Previously created NLP algorithms were used to extract information on diagnoses and prescribed medications (Perera et al., 2016). Manual review of unstructured fields where long-form clinical entries were recorded was used to extract sociodemographic information, psychiatric symptoms, and substance use. All patient identifiable information was removed prior to use by the CRIS application, including patient, family or friends' names, and location information. All data remained within the NHS firewall during analysis. Unstructured fields were reviewed by investigators and data were entered into a database using a custom data entry interface. A subset of the sample was re-scored by NJK, a consultant psychiatrist, to estimate inter-rater reliability; estimates of Cohen's kappa differed by variable but were generally strong, ranging from 0.72 to 0.94. Database queries and data extraction, processing, entry and analysis were implemented in the R software (version 3.5.1) (R Core Team, 2016).

Approvals

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and

https://doi.org/10.1017/S0033291720003451 Published online by Cambridge University Press

institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved via the Oxford C Research Ethics Committee (NRES: 08/H0606/71 + 5), which covers all uses of CRIS as an anonymised database for secondary analysis (Perera et al., 2016). Approval from the CRIS oversight committee was obtained for this specific project under the title 'Project 17-104 Alcohol and drugs of abuse in the Place of Safety'. Written or verbal consent from patients was therefore not required as the data used were pseudonymised, however, the use of these data for research via CRIS is widely publicised across the SLaM NHS trust, including the option for service users to opt-out of such involvement. A pre-registration for this study is available (DOI *https://osf.io/acpxr*).

Measures

For this research, we focused on recent substance use rather than long-term patterns of use. Information on substance use could be drawn from multiple sources including structured fields based on service user report and/or observations of police or clinical staff, physical measurements (breathalyser readings for alcohol, urine drug screens for other drugs), records in unstructured fields of self-reported substance use, and presence of scores for alcohol withdrawal and/or administration of chlordiazepoxide. We developed hierarchical algorithms for integrating this information to determine whether there was evidence for recent use of each substance of interest. Further details are provided in the Supplementary Material Section 1.

For descriptive analyses, binary indicators were used for recent use of the following substances: alcohol, cannabis, stimulants (amphetamines, cocaine, mephedrone), synthetic cannabinoids, and other drugs (opiates, benzodiazepines, gamma hydroxybutyrate, MDMA). For other analyses focused on the use of cannabinoids (including synthetic cannabinoids) and stimulants, a single variable was derived with the following categories: *neither*, *cannabinoids only, stimulants only*, *cannabinoids and stimulants*. Synthetic cannabinoids were combined with cannabis because there were only 26 reported instances of use in the dataset, and only nine of these involved the use of synthetic cannabinoids alone.

A binary indicator was used for the presence of acute psychotic symptoms, defined by recorded nursing observations or Mental State Examination by the assessing psychiatrists during the cPOS spell of care. Delusions, reported hallucinations or responding to unseen stimuli, or Formal Thought Disorder was the indicative symptoms of interest. This procedure has been used previously in EHR research to compare symptoms in acute psychiatric illness in drug users (Bassir Nia et al., 2016). The presence of observed psychotic symptoms was chosen rather than a previous diagnosis of the psychotic disorder as the focus of the study was the relationship between the acute mental state and recent substance use. Based on a manual review of the unstructured fields, we recorded the presence or absence of evidence of physical violence by a detained individual towards patients, staff, or property. This included direct physical contact (e.g. punching, kicking, biting) and/or use of projectiles (e.g. throwing bottles at people or objects, damaging windows, doors or furniture). Self-harm was not included. Age in years was treated as a continuous variable, derived from individual month and year of birth (exact date of birth is not provided to facilitate anonymity), and the date of detention at cPoS. Gender was a binary variable, *female* or *male*, as recorded by clinical staff.

Statistical analysis

Initial descriptive analyses of variables were conducted using means, standard deviations, counts and proportions as appropriate for variable type. Bivariable associations with the primary outcome variable, violent events, were conducted using t tests, chi-squared tests or Fisher's exact test as appropriate. For the primary analysis, multivariable binomial logistic regression was used to model the association between violent events during detention and the interaction between cannabinoid/stimulant use and psychotic symptoms, adjusting for age, gender, and recent alcohol use. This interaction term was pre-specified; pre-registration for this study can be found at https://osf.io/acpxr. As this study is not focused on developing a prediction model, all variables were all included in the model and no further selection strategies were implemented. The full model results are reported as regression coefficients with 95% confidence intervals (CI), with the odds ratios (OR), 95% CI, and p values for the interaction between cannabinoid/stimulant use and psychotic symptoms reported separately.

We imputed missing covariate values using Multiple Imputation by Chained Equations (MICE) as implemented for the R software (Van Buuren & Groothuis-Oudshoorn, 2011), following previously published guidance for implementation and reporting (see Supplementary Material Section 2 for further details) (White, Royston, & Wood, 2011). A total of 50 imputed datasets were generated. Variable distributions from observed and imputed datasets were compared and results from analyses of the individual datasets combined using Rubin's rules. We conducted two types of sensitivity analysis to investigate the robustness of our results. First, we assessed the impact of departures from the Missing At Random assumption on results (van Buuren, 2018). Second, we examined the impact of analysing data from all detention episodes in the dataset (i.e. some service users were detained more than once during the time period); note that this is only a simple sensitivity analysis and does not account for correlations between multiple detentions of the same person. Further details are provided in Supplementary Material Sections 2 and 3. All analyses were conducted using the R software (version 3.5.1) (R Core Team, 2016). All tests were two-tailed but thresholds for declaring statistical significance were not applied; effect estimates, CI, and p values were evaluated together to determine the importance of results (Greenland et al., 2016).

Results

After applying inclusion/exclusion criteria (Fig. 1), the sample included 1089 unique individuals involved in 1384 detentions; only the first detention episode was included in the main analyses. A violent incident was recorded in 12.6% ($n = 127$) of detentions (Table 1), with the majority (75.5%) of incidents involving the physical assault of staff or rarely, other patients. Women were detained in 38.8% of cases ($n = 423$) and the average age of individuals was 35 years (s.d. 11 years).

Most detentions (64.5%; $n = 702$) involved recent use of alcohol and/or other drugs. Alcohol was most commonly used (47% of detentions), followed by cannabis (23%), and stimulants (17%). Other drugs such as heroin, benzodiazepines, and party drugs were reported in 7% of detentions, with heroin and benzodiazepines most commonly used. Use of multiple substances was recorded in 40% detentions involving alcohol or other drugs.

https://doi.org/10.1017/S0033291720003451 Published online by Cambridge University Press

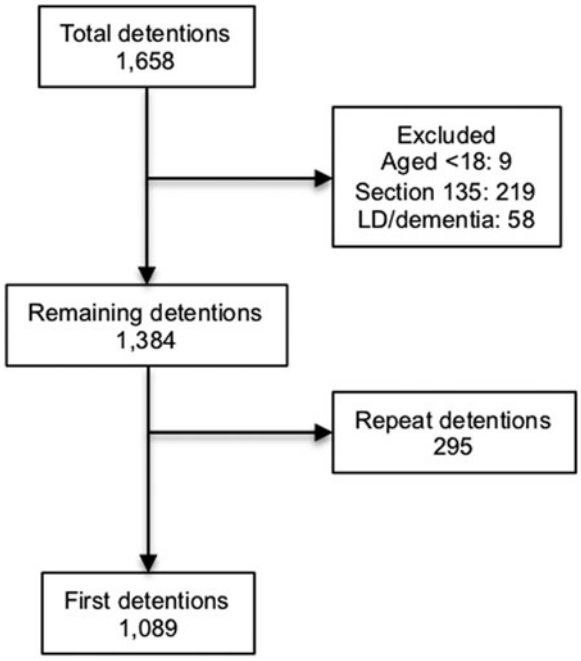

Fig. 1. Flowchart of cPoS detainees with those excluded and included in the sample for analysis. LD indicates learning disability.

Synthetic cannabinoid use was recorded in 2.4% of detentions (n = 26) and its use in isolation was only recorded in nine detentions. There was a negative association between recent use of alcohol and violence, and a positive association between recent use of cannabinoids (cannabis or synthetic cannabinoids) and violence (see Table 1). Acute psychotic symptoms were recorded in almost a third of detentions (36%; n = 388) and associated with violence during detention.

In total 900 of 1089 people (83%) had complete data for substance use, psychotic symptoms, age, gender, and the outcome of a violence event during the detention. The incomplete cases were due to missing data on substance use (13% missing) and psychotic symptoms (5%). The characteristics of incomplete cases did not differ substantially from complete cases apart from being more likely to be female (50.5% *v.* 41.8%).

Estimates from the multivariable model (see Tables 2 and 3) indicated a strong association between psychotic symptoms and violent events that was increased in the presence of recent cannabinoid use. Compared to individuals who did not display psychotic symptoms and for whom there was no record of cannabinoid/stimulant use, the odds of a violent event were three-fold higher for individuals displaying psychotic symptoms (OR 4.0, 95% CI 2.2–7.4; $p < 0.0001$). The odds of a violent event were five-fold higher if recent cannabis use was also recorded (OR 7.1, 95% CI 3.7–13.6; $p < 0.0001$). There was limited evidence for an association between stimulant use without cannabis use and violent events, regardless of the presence of psychotic symptoms. However, stimulant use combined with cannabinoid use in the absence of psychotic symptoms was associated with increased odds of violence (OR 3.3, 95% CI 1.4–7.9; $p < 0.0001$). There was no evidence for an association with either gender or age, suggesting that although these demographic risk factors are associated with violence in the general population that is not the case in this setting. Alcohol use was not associated with violence.

Results from the complete case analysis did not differ substantially from the multiple imputation results (see Supplementary Material Section 2). Including multiple detentions per person produced similar results to the full dataset, although with attenuated effect size estimates (see Supplementary Material Section 3). In particular, the effect sizes for cannabinoid use and combined cannabinoid/stimulant use in the *absence* of psychotic symptoms were lower with a lower confidence interval bound closer to the null (OR 1.7, 95% CI 0.9–3.1, $p = 0.1$; OR 1.9, 95% CI 0.83–4.1, $p = 0.13$ respectively).

Discussion

Our findings suggest that the odds of physical violence by patients in an emergency psychiatric context are increased four-fold in those with acute psychotic symptoms, and over seven-fold if cannabinoids have also recently been used. Recent use of cannabinoids in combination with stimulants in those *without* psychotic symptoms may increase the odds of violence three-fold. This is the first study to investigate the relationship between recent use of different illicit substances, as well as polysubstance use, and acute psychiatric symptoms in a large emergency psychiatric sample. Recent use of substances was common in service

Table 1. Sample characteristics for complete analysis sample (1089 detentions) and by violence to person or property during detention

			Violence during detention				
			Yes		No		
	Number with missing data	All individuals	*N*	%	*N*	%	*p*
Total		1089	127	12.6	952	87	–
Female	0	423	46	33.6	377	39.6	0.21
Recent alcohol use	146	514	51	37.2	463	48.6	<0.01
Recent cannabis use	146	287	55	40.1	232	24.4	<0.001
Recent synthetic cannabinoid use	146	26	8	5.8	18	1.9	0.01
Recent stimulant use	146	191	21	15.3	170	17.9	0.5
Other recent drug use	146	103	13	9.5	90	9.5	1
Psychotic symptoms	54	388	83	60.6	305	32	<0.001

Data are presented as number and percent; *p* values are from chi-squared test excluding missing values.

https://doi.org/10.1017/S0033291720003451 Published online by Cambridge University Press

Table 2. Estimates for the interaction between acute psychotic symptoms and recent cannabinoid/stimulant use from the model for physical violence during detention, based on the multiply imputed data (1098 individuals)

	Cannabinoid/stimulant use			
Psychotic symptoms	Neither	Cannabinoids	Stimulants	Both
No	Reference	2.2 (1.1,4.5); 0.03	1.32 (0.5,3.7); 0.59	3.3 (1.4,7.9); <<0.001
Yes	4.0 (2.2,7.4); <<0.001	7.1 (3.7,13.6); <<0.001	1.7 (0.5,5.9); 0.42	2.6 (0.8,8.0); 0.1

Data are presented as odds ratio (95% confidence interval); *p* value.

users detained to the Place of Safety, with nearly a quarter having evidence of recent use of cannabinoids, making the finding of an associated increase in violence an important consideration in this context. Neither gender nor age was associated with violence, suggesting that the clinical factors of cannabinoid use in the presence of psychotic symptoms, or polysubstance use of cannabinoids and stimulants, are more important in determining risk in this setting.

Our findings are relevant to any setting where people present with acute psychiatric symptoms in the context of drug intoxication, for example, emergency departments, and perhaps of increasing relevance in North America, where cannabis legalisation could see increased use (Hall & Lynskey, 2016). Previous studies of this topic have primarily only described the frequency of a history of substance use in those who have acted aggressively in emergency or acute psychiatric settings. Further, most previous research has only considered a history of substance use, rather than acute use, and has not distinguished between classes of drugs (Cornaggia et al., 2011; Dack et al., 2013). A recent meta-analysis confined their analysis of violence on in-patient wards to patients with a history of alcohol use disorder because the history of drug use disorder was not commonly reported (Iozzino et al., 2015). Alcohol was associated with violence in the meta-analysis but not in our study. This may relate to the fact that a substantial proportion of our sample who were alcohol-intoxicated were detained for psychiatric assessment due to exhibiting suicidal behaviour, rather than behavioural disturbance (unpublished observations). Alcohol use in association with suicidal acts has also been reported in other Section 136 cohorts (Bendelow, Warrington, Jones, & Markham, 2019). Those intoxicated with alcohol who are behaving aggressively may be understood as drunk rather than mentally disordered by police and may therefore be arrested or detained in police custody, rather than being detained in a healthcare setting for psychiatric assessment (Bendelow et al., 2019). Further, the meta-analysis showing a positive association between alcohol and violence on acute wards used historic rather than acute use. Wards are also the places where access to alcohol would be eliminated, so the association may reflect alcohol withdrawal delirium, which is associated with violence. Alcohol withdrawal delirium would not have had time to develop during the short duration of Section 136 detention, as it typically develops after 48 h of alcohol withdrawal (Haber, Lintzeris, Proude, & Lopatko, 2009; Tomlinson, Brown, & Hoaken, 2016). The association between alcohol and violence in mental health settings is also not universal: a recent study by Bassir Nia et al. (2016) in a dual diagnosis setting also found a reduced odds of violence in those who had used alcohol prior to admission.

This study also adds to the broader literature concerning psychotic disorders, substance misuse, and violence. Most cohort studies relating lifetime diagnosis to convictions and cross-sectional self-report studies investigating this relationship have found that comorbid substance misuse increases the risk of violence in people with psychotic disorders. Most such studies, reviewed in a systematic review by Nederlof and colleagues,

Table 3. Estimates from the full multivariable logistic regression model for physical violence during detention, fitted to the multiply imputed data (1098 individuals)

	Categories	Coefficient	95% CI	*p*
Psychotic symptoms	No	Reference		
	Yes	1.4	0.79–2.0	6.8×10^{-6}
Cannabinoid/stimulant use	Neither	Reference		
	Cannabinoids	0.79	0.07–1.51	0.03
	Stimulants	0.28	−0.74 to 1.30	0.59
	Both	1.19	0.33–2.06	0.007
Alcohol use	No	Reference		
	Yes	−0.2	−0.63 to 0.23	0.36
Gender	Female	Reference		
	Male	0.14	−0.26 to 0.55	0.49
Age	NA	0.003	−0.01 to 0.02	0.71
Interaction terms	Psychotic symptoms × cannabinoids	−0.23	−1.15 to 0.68	0.62
	Psychotic symptoms × stimulants	−1.16	−2.78 to 0.46	0.16
	Psychotic symptoms × both	−1.64	−3.07 to −0.21	0.02

Data are presented as regression coefficients with 95% confidence intervals (CI) and associated *p* values.

https://doi.org/10.1017/S0033291720003451 Published online by Cambridge University Press

have used an aggregated term encompassing alcohol and drug misuse rather than distinguishing by the substance (Nederlof, Muris, & Hovens, 2013). A recent meta-analysis of cannabinoid use in patients with severe mental illness found that both use and misuse increased the risk but no distinction was made between historical and recent use and the relationship was with diagnosis rather than acute symptoms (Dellazizzo et al., 2019). Rasanen and colleagues found that comorbid alcohol dependence alone increased the risk of violence in people with a lifetime diagnosis of schizophrenia (Räsänen et al., 1998). This is in contrast to our study and may reflect the disparate handling of aggressive behaviour in alcohol intoxication as described above.

EHR data have inherent limitations. Missing data are inevitable due to staff not recording information, such as substance use, or patient reluctance to disclose. However, missing data for our primary outcome, violence towards people or property, is likely to be very limited as such events are cited to explain decision-making regarding restrictive interventions such as manual restraint. The impact of missing data on our results was minimised via multiple imputations, and the results obtained from the imputed dataset were very similar to those from the complete case analysis. Another potential limitation is the incorporation of urine testing into the algorithm for defining recent use of cannabis, as in daily users this can remain positive for up to 15 days, and in heavy daily users, 30 days (Moeller, Kissack, Atayee, & Lee, 2017).

The nature of EHR data also provides many of the strengths of this study. Our sample is one of the largest and most well-characterised datasets of people detained under Section 136 of the MHA, a population with high rates of both psychotic symptoms and acute substance use. Environmental factors contributing to violence were minimised as all episodes of care took place in the same emergency setting with a dedicated team. We used multiple data sources to classify substance use, given known under-reporting in EHR data (Bell et al., 2013) and data from unstructured fields that contained a contemporaneous evaluation of substance use and psychiatric symptoms rather than relying on retrospective reports from staff or patients. Violence was stringently defined as actual physical aggression: either assault or damage to property. Finally, acute psychotic symptoms were evaluated rather than a diagnosis of psychotic disorder, which is more informative in understanding how acute mental state and substance use interact.

In conclusion, psychotic disorders and a history of substance are recognised risk factors for aggression in emergency and acute psychiatric settings. This study extends the literature by demonstrating how acute psychotic symptoms and recent use of cannabinoids are associated with greater risk in combination than either alone. This finding is of relevance to emergency settings where patients in psychotic crisis with recent cannabinoid use are cared for as understanding of this increase in risk could inform tailored management plans and reduce the use of restrictive interventions. Given that cannabis use is likely to become more common in several countries as a result of legalisation (Hall & Lynskey, 2016), management of patients who have recently used cannabis is likely to be of increasing relevance to clinicians in emergency services.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0033291720003451.

Data. The dataset is made up of National Health Service (NHS) patient records and therefore cannot be directly shared. The ethical approval to access CRIS data (Oxfordshire Research Ethics Committee C 08/H0606/71 + 5) 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. More information about accessing data held by the NIHR Maudsley Biomedical Research Centre can be found here: https://www.maudsleybrc.nihr.ac.uk/facilities/clinical-record-interactive-search-cris.

A pre-registration for this study is available (DOI https://osf.io/acpxr). All authors had access to the study data during the period of data analysis.

Acknowledgements. The authors wish to thank all service users and staff from the SLaM centralised Place of Safety who provided the data for this study. This work was supported by a grant from the Wellcome Trust [109823/Z/15/Z] to KIM; NJK was supported by a NIHR Clinical Lectureship. JER was supported by a Society for the Study of Addiction student bursary.

This manuscript represents independent research part-funded by the National Institute for Health Research (NIHR) Biomedical Research Centre at South London and Maudsley NHS Foundation Trust and King's College London. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.

Author contributions. The literature search was conducted by NJK, JER and KIM. NJK, KRR, VC, and KIM were involved in the conception and design of the study. NJK, MP, and KIM created the data extraction protocol. Manual scoring of the unstructured fields was performed by NJK, JER, KRR, and KIM. Data analysis was performed by KIM. Data interpretation was by NJK, MTL, VC, and KIM. NJK and KIM drafted the manuscript with input from all other authors. All authors approved the final version of the article. NJK is the guarantor.

Conflict of interest. None.

References

Bassir Nia, A., Medrano, B., Perkel, C., Galynker, I., & Hurd, Y. L. (2016). Psychiatric comorbidity associated with synthetic cannabinoid use compared to cannabis. *Journal of Psychopharmacology*, *30*(12), 1321–1330. doi:10.1177/0269881116658990.

Bell, J., Kilic, C., Prabakaran, R., Wang, Y. Y., Wilson, R., Broadbent, M., … Curtis, V. (2013). Use of electronic health records in identifying drug and alcohol misuse among psychiatric in-patients. *The Psychiatrist*, *37*, 15–20. doi:10.1192/pb.bp.111.038240.

Bendelow, G., Warrington, C. A., Jones, A. M., & Markham, S. (2019). Police detentions of 'mentally disordered persons': A multi-method investigation of section 136 use in Sussex. *Medicine, Science and the Law*, *59*(2), 95–103. doi:10.1177/0025802419830882.

Cornaggia, C. M., Beghi, M., Pavone, F., & Barale, F. (2011). Aggression in psychiatry wards: A systematic review. *Psychiatry Research*, *189*(1), 10–20. doi:10.1016/j.psychres.2010.12.024.

Dack, C., Ross, J., Papadopoulos, C., Stewart, D., & Bowers, L. (2013). A review and meta-analysis of the patient factors associated with psychiatric in-patient aggression. *Acta Psychiatrica Scandinavica*, *127*(4), 255–268. doi:10.1111/acps.12053.

Dellazizzo, L., Potvin, S., Beaudoin, M., Luigi, M., Dou, B. Y., Giguère, CÉ, & Dumais, A. (2019). Cannabis use and violence in patients with severe mental illnesses: A meta-analytical investigation. *Psychiatry Research*, *274* (December 2018), 42–48. doi:10.1016/j.psychres.2019.02.010.

Fazel, S., Gulati, G., Linsell, L., Geddes, J. R., & Grann, M. (2009). Schizophrenia and violence: Systematic review and meta-analysis. *PLoS Medicine*, *6*(8), e1000120. doi:10.1371/journal.pmed.1000120.

Greenland, S., Senn, S. J., Rothman, K. J., Carlin, J. B., Poole, C., Goodman, S. N., & Altman, D. G. (2016). Statistical tests, *p* values, confidence intervals, and power: A guide to misinterpretations. *European Journal of Epidemiology*, *31*(4), 337–350. doi:10.1007/s10654-016-0149-3.

Haber, P., Lintzeris, N., Proude, E., & Lopatko, O. (2009). Alcohol withdrawal management. Guidelines for the Treatment of Alcohol Problems.

Hall, W., & Lynskey, M. (2016). Evaluating the public health impacts of legalizing recreational cannabis use in the United States. *Addiction* (*Abingdon, England*), *111*(10), 1764–1773. doi:10.1111/add.13428.

Healthy London Partnership (2017). Mental Health Crisis Care for Londoners: London's section 136 pathway and Health Based Place of safety specification.

Iozzino, L., Ferrari, C., Large, M., Nielssen, O., & de Girolamo, G. (2015). Prevalence and risk factors of violence by psychiatric acute inpatients: A systematic review and meta-analysis. *PloS One*, *10*(6), e0128536. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26061796. Iozzino, L., Ferrari, C., Large, M., Nielssen, O., & De Girolamo, G. (2015). Prevalence and risk factors of violence by psychiatric acute inpatients: A systematic review and meta-analysis. PLoS ONE, 10(6). https://doi.org/10.1371/journal.pone.0128536.

Kaeser, D., Guerra, R., Keidar, O., Lanz, U., Moses, M., Kobel, C., … Ricklin, M. E. (2018). Verbal and Non-verbal aggression in a Swiss university emergency room: A descriptive study. *International Journal of Environmental Research and Public Health*, *15*(7), 1423. https://www.ncbi.nlm.nih.gov/pubmed/29986402.

Lecomte, T., Dumais, A., Dugré, J. R., & Potvin, S. (2018). The prevalence of substance-induced psychotic disorder in methamphetamine misusers: A meta-analysis. *Psychiatry Research*, *268*(May), 189–192. doi:10.1016/j.psychres.2018.05.033.

Maharaj, R., Gillies, D., Andrew, S., & O'Brien, L. (2011). Characteristics of patients referred by police to a psychiatric hospital. *Journal of Psychiatric and Mental Health Nursing*, *18*(3), 205–212. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21395912.

Marconi, A., Di Forti, M., Lewis, C. M., Murray, R. M., & Vassos, E. (2016). Meta-Analysis of the association between the level of cannabis use and risk of psychosis. *Schizophrenia Bulletin*, *42*(5), 1262–1269. doi:10.1093/schbul/sbw003.

Moeller, K. E., Kissack, J. C., Atayee, R. S., & Lee, K. C. (2017). Clinical interpretation of urine drug tests: What clinicians need to know about urine drug screens. *Mayo Clinic Proceedings*, *92*(5), 774–796. doi:10.1016/j.mayocp.2016.12.007.

Nederlof, A. F., Muris, P., & Hovens, J. E. (2013). Aggression and violent behavior The epidemiology of violent behavior in patients with a psychotic disorder: A systematic review of studies since 1980. *Aggression and Violent Behavior*, *18*(1), 183–189. doi:10.1016/j.avb.2012.11.018.

Nikathil, S., Olaussen, A., Symons, E., Gocentas, R., O'Reilly, G., & Mitra, B. (2018). Increasing workplace violence in an Australian adult emergency department. *Emergency Medicine Australasia: EMA*, *30*(2), 181–186. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/29117641.

Perera, G., Broadbent, M., Callard, F., Chang, C., Downs, J., Dutta, R., … Stewart, R. (2016). Cohort profile of the South London and Maudsley NHS foundation trust biomedical research centre (SLaM BRC) case register: Current status and recent enhancement of an electronic mental health record-derived data resource. *BMJ Open*, *6*, e008721. doi:10.1136/bmjopen-2015-008721.

Pich, J. V, Kable, A., & Hazelton, M. (2017). Antecedents and precipitants of patient-related violence in the emergency department: Results from the Australian VENT study (Violence in Emergency Nursing and Triage). *Australasian Emergency Nursing Journal: AENJ*, *20*(3), 107–113. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/28705687.

Räsänen, P., Tiihonen, J., Isohanni, M., Rantakallio, P., Lehtonen, J., & Moring, J. (1998). Schizophrenia, alcohol abuse, and violent behavior: A 26-year followup study of an unselected birth cohort. *Schizophrenia Bulletin*, *24*(3), 437–441.

R Core Team (2016). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.

Shafi, A., Gallagher, P., Stewart, N., Martinotti, G., & Corazza, O. (2017). The risk of violence associated with novel psychoactive substance misuse in patients presenting to acute mental health services. *Human Psychopharmacology: Clinical and Experimental*, *32*(3), e2606. doi:10.1002/hup.2606.

Speroni, K. G., Fitch, T., Dawson, E., Dugan, L., & Atherton, M. (2014). Incidence and cost of nurse workplace violence perpetrated by hospital patients or patient visitors. *Journal of Emergency Nursing: JEN: Official Publication of the Emergency Department Nurses Association*, *40*(3), 218–228; quiz 295. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24054728.

Svoboda, T. (2014). Difficult behaviors in the emergency department: A cohort study of housed, homeless and alcohol dependent individuals. *PloS One*, *10*(4), e0124528. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25919015.

Tomlinson, M. F., Brown, M., & Hoaken, P. N. S. (2016). Recreational drug use and human aggressive behavior: A comprehensive review since 2003. *Aggression and Violent Behavior*, *27*, 9–29. doi:10.1016/j.avb.2016.02.004.

Unadkat, A., Subasinghe, S., Harvey, R. J., & Castle, D. J. (2019). Methamphetamine use in patients presenting to emergency departments and psychiatric inpatient facilities: What are the service implications? *Australasian Psychiatry*, *27*(1), 14–17. doi:10.1177/1039856218810155.

van Buuren, S. (2018). *Flexible imputation of missing data* (2nd ed.). Boca Raton, FL: CRC/Chapman & Hall.

Van Buuren, S., & Groothuis-Oudshoorn, K. (2011). Multivariate imputation by chained equations in R. *Journal Of Statistical Software*, *45*(3), 1–67. doi:10.1177/0962280206074463.

Vos, P. J., Cloete, K. J., Le Roux, A., Kidd, M., & Jordaan, G. P. (2010). A retrospective review of trends and clinical characteristics of methamphetamine-related acute psychiatric admissions in a South African context. *African Journal of Psychiatry*, *13*(5), 390–394. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21390410.

White, I. R., Royston, P., & Wood, A. M. (2011). Multiple imputation using chained equations: Issues and guidance for practice. *Statistics in Medicine*, *30*(4), 377–399. doi:10.1002/sim.4067.

Wicomb, R., Jacobs, L., Ebrahim, N., Rensburg, M., & Macharia, M. (2018). Illicit drug use and violence in acute psychosis among acute adult admissions at a South African psychiatric hospital. *African Health Sciences*, *18*(1), 132–136. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/29977266.

Yalcin, S., & Bilgin, H. (2019). Risk predictions of physical aggression in acute psychiatric wards: Findings of a prospective study. *Nursing & Health Sciences*, *2019*, 1–7. doi: nhs.12599. 10.1111/nhs.12599.

Zisman, S., & O'Brien, A. (2015). A retrospective cohort study describing six months of admissions under section 136 of the Mental Health Act; the problem of alcohol misuse. *Medicine, Science, and the Law*, *55*(3), 216–222. doi:10.1177/0025802414538247.

https://doi.org/10.1017/S0033291720003451 Published online by Cambridge University Press