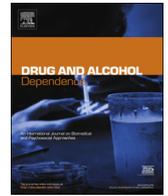




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Aggression and violence at ambulance attendances where alcohol, illicit and/or pharmaceutical drugs were recorded: A 5-year study of ambulance records in Victoria, Australia



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ABSTRACT

Background: This study describes the frequency and characteristics of aggression and/or violence in ambulance attendances involving alcohol, illicit and/or pharmaceutical drug use in Victoria, Australia between January 2012 and January 2017.

Methods: Patient characteristics, context, and substance use involvement in ambulance attendances were examined to determine associations with attendances where aggression and/or violence was recorded.

Results: There were 205,178 ambulance attendances where use of alcohol, pharmaceutical drugs or illicit substances contributed to the reason for the attendance. Paramedics recorded acts of aggression and/or violence in 11,813 (5.76 %) of these attendances. Aggression/violence was more likely to be recorded in certain contexts. Compared with attendances where aggression/violence was not recorded, attendances where aggression/violence was recorded were significantly more likely to involve younger and male patients, and occur on Friday and Saturday nights. Alcohol intoxication was involved in more than half of attendances where aggression/violence was recorded, and was almost twice as prevalent as those involving illicit drug use where aggression/violence was recorded. This pattern was consistent across all hours, high-alcohol hours only, by metropolitan/regional location, and by police co-attendance.

Conclusions: Aggression and violence are frequently recorded in ambulance attendances involving alcohol, pharmaceutical drugs or illicit substances, and, most often involve alcohol. This violence poses a recurring threat to the health and safety of paramedics, bystanders, and patients. Greater priority should be given to reducing alcohol-related violence through evidence-based policy measures targeting high-risk groups (e.g. young adult males) and contexts (e.g. weekends, late at night) where harm is most likely to occur.

1. Introduction

In 2016, approximately 25 % of Australians aged 14 years and over consumed alcohol at levels placing them at risk for short-term harms at

least once a month (Australian Institute of Health and Welfare, 2017). Additionally, approximately 12 % and 5 % had recently used illicit drugs or misused pharmaceutical drugs, respectively (Australian Institute of Health and Welfare, 2017). The use of alcohol or illicit drugs

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is also linked to harmful activities, such as verbally abusing someone (6.8 % of single occasion risky drinkers and 2.8 % of illicit drug users) and physically abusing someone (1 % of single occasion risky drinkers and 0.6 % of illicit drug users) (Australian Institute of Health and Welfare, 2017).

Considerable research identifies both alcohol and illicit drug use as significant individual risk factors for aggressive and violent behaviour (Boles and Miotto, 2003). Alcohol use, for example, can instigate and increase aggression due to pharmacological effects that depress an individual's executive functioning and lead to disinhibition of aggressive impulses (Giancola et al., 2010). Illicit drug use is also associated with aggressive and violent behaviour, not only because of the pharmacological effects, but also because of the economic and systemic ties between illicit drug markets and violence (Goldstein et al., 1989). A recent longitudinal study of methamphetamine users found evidence of a dose-response increase in violent behaviour, largely independent of psychotic symptoms (McKetin et al., 2014). There is also some evidence, though mixed, of a link between some types of pharmaceutical drug use (e.g. benzodiazepines) and violent behaviour (Albrecht et al., 2014). However, not all substance users are violent, and the effect of substance use on violent behaviour is contingent on a host of individual factors (e.g. age, gender, childhood experiences, personality traits), patterns of substance use, the different pharmacological effects of substances and their interactions, as well as various social, cultural and contextual factors that shape attitudes and behaviours towards substance use and violence in the population (Fals-Stewart et al., 2005).

Studies have shown that although perpetrators of substance-related violence are frequently known by their victims (e.g. relatives, intimate partners, friends, co-workers), a large proportion of perpetrators are strangers to the victim (Laslett et al., 2011; Sommers and Baskin, 2006). In the latter case, those who attend to, and care for, individuals experiencing acute effects and harms from substance use (e.g. intoxication, overdose, injury), including law enforcement officers (Donnelly et al., 2007; Legislative Assembly Committee on Law and Safety, 2017; Roche et al., 2009), hospital workers (Drugs and Crime Prevention Committee, 2011; Egerton-Warburton et al., 2016; Phillips, 2016), and pre-hospital workers such as paramedics (Grange and Corbett, 2002; Heilbronn et al., 2015; Petzäll et al., 2011), are at particular risk of aggressive and/or violent behaviour.

There are increasing media reports of violence at ambulance attendances in Australia (Dow, 2018; Power, 2018), and growing recognition by governments of this problem as a significant community safety issue (Andrews, 2018). A small body of Australian research measures and describes the magnitude of the problem (Boyle et al., 2007; Heilbronn et al., 2015; Koritsas et al., 2009; Maguire, 2018; Maguire et al., 2014). While there are policies in place in Australia that attempt to reduce aggression/violence at ambulance attendances (Victorian Government, 2015), there is a lack of peer-reviewed literature on the effectiveness of any interventions to curb the increasing experience of violence (Maguire et al., 2018). A number of factors may contribute to violence at ambulance attendances, including paramedic factors (e.g., qualifications, gender, hours per week in contact with patients), patient factors (e.g., alcohol and drug use, being a victim of violence, mental health disorders), and environmental risk factors (e.g., time of day) (Gillespie et al., 2010; Koritsas et al., 2009). A recent parliamentary inquiry in Australia identified substance use, along with other factors such as mental illness, as one of the main individual-level contributing factors to violence at ambulance attendances (Legislative Assembly Committee on Law and Safety, 2017). However, given the research evidence of differences between substance types in their contribution to violence (Boles and Miotto, 2003), the differences in substance availability and legal status in Australia, and hence, the different implications for policy and program investment decisions, it is important that the involvement of substance use in aggression and/or violence at ambulance attendances is examined in detail. Ambulance data can provide comprehensive information regarding identifying

trends in aggression and/or violence and identifying at-risk groups (Masho et al., 2014; Quigg et al., 2017) and provide information that is not available in ED data (e.g., exact location of aggression/violence; Downing et al., 2005). The relatively scarce resources for alcohol and other drug treatment programs in Australia, which represent just 0.8 % of total health-care expenditure (Ritter et al., 2015), further underlines how important it is that policies and government investment in programs to reduce substance-related harm are informed by sound evidence.

This study uses data from an internationally unique, ongoing surveillance system of ambulance attendances involving alcohol, illicit and/or pharmaceutical drug use in Victoria, Australia. We aimed to address the question of which individual, contextual, and substance type factors are more likely to characterise ambulance attendances where aggression and violence are recorded, compared with attendances where aggression and violence is not recorded. This aggression and/or violence may be aggression directed from or towards other members of the public (known or unknown to the individual being treated), aggressive behaviour that leads to property damage, or aggression/violence directed towards paramedics or police on the scene. The study adds to existing knowledge about substance-related harm in the population by examining aggression and violence in ambulance attendances, which is often not fully captured by analyses that rely only on police or hospital data (Ariel et al., 2015; Quigg et al., 2017; Taylor et al., 2016). By identifying salient characteristics of ambulance attendances where aggression and violence is recorded, this study aimed to provide evidence to inform policy responses to substance-related violence in the community.

2. Methods

2.1. Data

This study uses data from a unique surveillance system known as the *Ambo Project: Drug and Alcohol-Related Ambulance Attendances* (for details see Dietze et al., 2000; Lloyd and McElwee, 2011). In brief, data are sourced from Ambulance Victoria's clinical electronic patient care record system, VACIS®. All attendance records are filtered to identify those where alcohol, other drugs or mental health symptomology are associated with the attendance. The records selected from the filtering include those where the primary reason for calling an ambulance may not be substance-related (e.g. road traffic crash, fall, assault), but substances contributed to the ambulance attendance. The selected records are provided to Turning Point where case notes are de-identified (all potentially identifiable information is removed) and data are transferred to a database where a team of research assistants review each clinical record and code the data. This coding occurs in a systematised and validated manner and the codes capture information held in the clinical notes (for details see Lloyd et al., 2015). Coders determine the involvement of substance use based on a criterion of whether or not it is reasonable to attribute immediate or acute (not chronic) over- or inappropriate ingestion of the substance or medication as a contributor for the reason of the ambulance attendance. The data are routinely assessed for inter-coder reliability and adherence to validated coding protocols.

As acknowledged in other studies that have used data from the *Ambo Project*, there are several advantages of ambulance data over hospital data for investigating the nature and extent of substance-related harm in the population (Kaar et al., 2015; Lloyd and McElwee, 2011). These include the comprehensiveness of patient and case information gathered at the scene by first-responders, and capturing details of attendances that involved substance use and which require medical attention but may not result in transport to hospital (Kaar et al., 2015). Furthermore, because data collection is integrated with paramedics' routine clinical procedures, it represents an efficient and low-cost system of ongoing surveillance of substance-related harm in

the population.

Data was analysed for the period January 2012 to January 2017, which included one brief gap in data collection, between October 2014 and December 2014, due to industrial action by paramedics at that time.

2.2. Measures

Ambulance attendances that involved substance use were categorised as follows. Alcohol-related attendances were coded as either alcohol intoxication attendances, or alcohol involvement attendances. Attendances coded as alcohol involvement were those where paramedics have recorded that alcohol was involved in the attendance and the patient may or may not be intoxicated. These may include attendances where the patient had consumed a small amount of alcohol (e.g. one glass of wine), through to those who may have consumed large amounts of alcohol prior to the ambulance arriving on scene. Alcohol intoxication attendances are a subset of alcohol involved attendances where the paramedic documented that the patient was intoxicated or had consumed sufficient quantity to be intoxicated by alcohol. In all attendances where there is any doubt as to whether or not the patient is intoxicated the coders default to 'alcohol involved', and therefore 'alcohol intoxication' may be underrepresented in the dataset. Alcohol intoxication attendances often relate to drunkenness and alcohol poisoning, but may also include those where alcohol was not the primary reason for the attendance and so include alcohol-related injuries and acute disease. Alcohol intoxication only attendances are a separate subset of alcohol intoxication attendances and are those where the paramedic's report is that only alcohol use, and no other substance use, was involved in the ambulance attendance and that the patient was significantly affected by alcohol. Illicit drug only attendances are those where use of one or more illicit drugs is involved. Illicit drugs may include: amphetamines; heroin; cannabis; cocaine; gamma-hydroxybutyrate; ecstasy; inhalants; other; and, unknown illicit drugs. Alcohol and other pharmaceutical drugs are specifically excluded from illicit drug only attendances. Pharmaceutical-related attendances are those where use of one or more pharmaceutical drugs contributed to the attendance. Pharmaceutical drug use may include: anticonvulsants; antidepressants; anti-psychotics; benzodiazepines; opioid analgesics; other analgesics; other pharmaceutical drugs; and unknown medication. Use of alcohol and illicit drugs are specifically excluded from the coding of pharmaceutical only attendances.

Attendances recorded by the paramedics as aggressive and/or violent were cases where an individual (either patient or bystander) at the scene had been aggressive and/or violent. Aggressive behaviour consists of patient or bystander aggression towards each other, police or paramedics (e.g., verbal abuse), whereas violence relates to an assault or an incident of domestic violence. Of note, this variable is recorded by the paramedics, and is not coded by the research team.

2.3. Analysis

This study was approved by the Eastern Health Human Research Ethics Committee. Statistical analysis was conducted using Stata 15 (StataCorp, 2017). Given the unit of analysis was ambulance attendances that involved substance use, it is possible that an individual patient may have been counted multiple times if they were attended to by ambulance on multiple, separate occasions. For our main analysis, the frequency of ambulance attendances that involved substance use are described and two groups are compared: attendances where aggression/violence was recorded and attendances where aggression/violence was not recorded. Categorical variables (gender, location, day of week, hour of day, type of substance use) were compared using Pearson's chi-squared (χ^2) tests, and standardised residuals (for day of week and hour of day variables). The continuous variable (age of patient) was compared using two sample *t*-tests.

Table 1

Frequency of aggression and/or violence recorded at ambulance attendances involving substance use, Victoria, January 2012 to January 2017.

	Aggression/violence recorded (n = 11,813)		No aggression/violence recorded (n = 193,365)	
	%	n	%	n
Mean (SE) age of patient (years)	34.96 (0.12)		39.19 (0.04)	
Gender:				
Male	68.85	8,133	57.60	111,383
Female	31.15	3,680	42.40	81,982
Location:				
Metropolitan	77.87	9,170	76.16	146,744
Regional	22.13	2,606	23.84	45,929
Day of Week:				
Monday	11.53	1,362	12.38	23,940
Tuesday	10.73	1,267	11.99	23,188
Wednesday	10.91	1,289	12.19	23,562
Thursday	11.51	1,360	12.62	24,404
Friday	14.37	1,697	14.50	28,031
Saturday	20.01	2,364	17.90	34,610
Sunday	20.94	2,474	18.43	35,630
Hour of day:				
6:00am-7:59pm	39.44	4,659	48.33	93,461
8:00pm-5:59am	60.56	7,154	51.67	99,904
Substance use:				
Alcohol intox. only	45.55	5,381	37.46	72,436
Alcohol intox. + illicit	4.06	480	2.81	5,425
Alcohol intox. + pharmaceutical	2.83	334	4.70	9,087
Alcohol intox. + illicit + pharmaceutical	0.37	44	0.34	650
Illicit only	11.40	1,347	12.04	23,289
Illicit + alcohol involved	7.31	863	5.34	10,332
Illicit + pharmaceutical	1.89	223	2.08	4,029
Illicit + pharma. + alcohol involved	0.87	103	0.70	1,356
Pharmaceutical only	4.87	575	14.56	28,155
Pharma. + alcohol involved	4.65	549	7.58	14,662

Bolded figures indicate where two sample *t*-tests (for mean age only) or Pearson's chi-squared (χ^2) tests find a statistically significant (< 0.01) group difference.

SE = standard error.

3. Results

3.1. Frequency and characteristics ambulance attendances where aggression and/or violence was recorded

There were 205,178 ambulance attendances where substance use was recorded in Victoria between January 2012 and January 2017, and aggression and/or violence was recorded in 11,813 (5.76 %) of these attendances. Table 1 shows that, compared to attendances where aggression/violence was not recorded, in attendances where aggression/violence was recorded the patient was significantly more likely to be younger ($t = 26.47, p < 0.001$) and male ($\chi^2 (1) = 578.90, p < 0.001$). Approximately three-quarters (76.26 %) of ambulance attendances where substance use was recorded occurred in metropolitan locations and approximately one quarter (23.74 %) in regional locations. This geographic distribution was significantly different for attendances where aggression/violence was recorded compared with those where it was not ($\chi^2 (1) = 17.88, p < 0.001$). There were also significant temporal differences in the frequency of attendances where aggression/violence was recorded compared with those where it was not, across both days of the week and hours of the day.

Aggression/violence at an ambulance attendance was significantly more likely to occur on Fridays, Saturdays and Sundays as compared to other days of the week ($\chi^2 (6) = 113.00, p < 0.001$), and also, as shown in Fig. 1, significantly more likely to occur between 8:00pm and 5:59am, peaking around midnight ($\chi^2 (23) = 557.71, p < 0.001$).

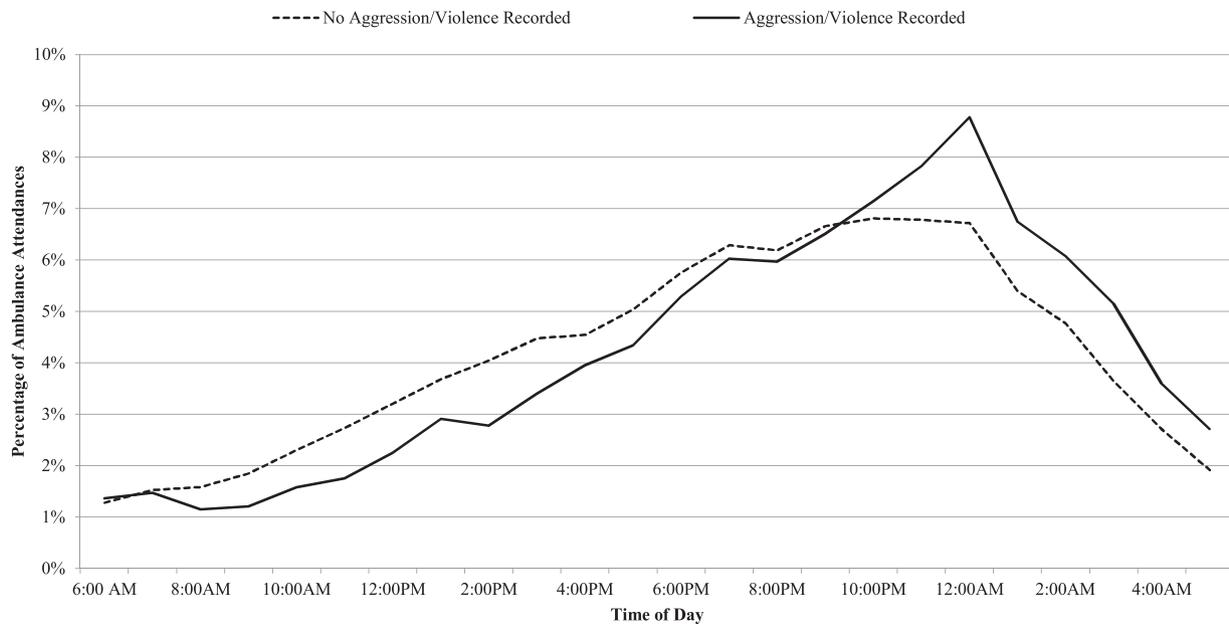


Fig. 1. Time of day of aggression and/or violence recorded at ambulance attendances involving substance use (% of total attendances), Victoria, January 2012 to January 2017.

3.2. The involvement of substances in aggression and/or violence

Alcohol intoxication only (no other substance use recorded) was the most frequent type of drug recorded in all ambulance attendances that involved substance use, and was significantly more likely in attendances where there was aggression/violence ($\chi^2 (1) = 309.6, \rho < 0.001$). Alcohol intoxication only was recorded in nearly half (45.6 %) of all aggressive/violent attendances, and was more than twice as prevalent (19.7 %) as aggressive/violent attendances involving any illicit drug use.

Aggression/violence was also significantly more likely where alcohol intoxication was combined with illicit drug use ($\chi^2 (1) = 63.0, \rho < 0.001$), and where illicit drug use involved alcohol use ($\chi^2 (1) = 83.1, \rho < 0.001$). However, aggression/violence was significantly less likely where substance use was recorded as alcohol intoxication combined with pharmaceutical use ($\chi^2 (1) = 89.1, \rho < 0.001$), pharmaceutical use only ($\chi^2 (1) = 868.6, \rho < 0.01$), or pharmaceutical use combined with alcohol use ($\chi^2 (1) = 139.7, \rho < 0.001$).

While illicit drug use only (no other substance use recorded) was the third most frequent type of substance use recorded overall, these attendances were not significantly more likely to involve aggression/violence ($\chi^2 (1) = 4.3, \rho = 0.037$).

3.3. Aggression and/or violence during high alcohol hours

Statewide, in ambulance attendances that involved substance use during high alcohol hours (HAH; 8pm-6am, Friday and Saturday nights), there were significant demographic differences between patients in aggressive/violent attendances compared with those attendances that were not aggressive/violent. In almost three quarters (73.4 %) of aggressive/violent attendances during HAH, the patient was male ($\chi^2 (1) = 362.6, \rho < 0.001$) and on average more than three years younger than patients in non-aggressive/non-violent attendances ($t = 11.3, \rho < 0.001$) (Table 2). Aggressive/violent attendances during HAH were also significantly more likely to involve alcohol intoxication only ($\chi^2 (1) = 17.4, \rho < 0.001$) and more likely to involve illicit drug use combined with alcohol use ($\chi^2 (1) = 4.3, \rho < 0.01$). However, aggressive/violent attendances during HAH were significantly less likely to involve alcohol intoxication combined with pharmaceutical use ($\chi^2 (1) = 27.2, \rho < 0.001$), pharmaceutical use only ($\chi^2 (1) = 132.7, \rho <$

Table 2

Frequency of aggression and/or violence recorded at ambulance attendances involving substance use in high alcohol hours^(a), Victoria, January 2012 to January 2017.

	Aggression/violence recorded (n = 3,397)		No aggression/violence recorded (n = 42,819)	
	%	n	%	n
Mean (SE) age of patient (years)	31.75 (0.22)		35.03 (0.08)	
Gender:				
Male	73.36	2,492	56.60	24,234
Female	26.64	905	43.40	18,585
Location:				
Metropolitan	74.36	2,517	74.58	31,787
Regional	25.64	868	25.42	10,834
Substance use:				
Alcohol intox. only	56.14	1,907	52.43	22,448
Alcohol intox. + illicit	4.74	161	4.14	1,744
Alcohol intox. + pharmaceutical	2.36	80	4.19	1,794
Alcohol intox. + illicit + pharmaceutical	0.29	10	0.35	151
Illicit only	5.65	192	7.21	3,086
Illicit + alcohol involved	7.65	260	6.72	2,877
Illicit + pharmaceutical	1.15	39	1.38	591
Illicit + pharma. + alcohol involved	0.71	24	0.66	283
Pharmaceutical only	1.65	56	6.62	2,835
Pharma. + alcohol involved	3.53	120	6.30	2,699

Bolded figures indicate where two sample *t*-tests (for mean age only) or Pearson's chi-squared (χ^2) tests find a statistically significant (< 0.01) group difference.

a. High-alcohol hours include 8:00pm Friday to 5:59am Saturday and 8:00pm Saturday to 5:59am Sunday.

SE = standard error.

0.001), and pharmaceutical use combined with alcohol use ($\chi^2 (1) = 42.2, \rho < 0.001$).

3.4. Locational differences in aggression and/or violence during high alcohol hours

Similar to the statewide trends, attendances involving aggression/violence in metropolitan locations during HAH were significantly more

Table 3

Frequency of aggression and/or violence recorded at ambulance attendances involving substance use in high alcohol hours^(a) according to location (metropolitan and regional), Victoria, January 2012 to January 2017.

	Metropolitan locations				Regional locations			
	Aggression/violence Recorded (n = 2,517)		No aggression/violence Recorded (n = 31,787)		Aggression/violence Recorded (n = 868)		No aggression/violence Recorded (n = 10,834)	
Mean (SE) age of patient (years)	31.51 (0.25)		34.77 (0.09)		32.45 (0.45)		35.75 (0.16)	
	%	n	%	n	%	n	%	n
Gender:								
Male	73.50	1,850	56.88	18,082	72.81	632	55.70	6,035
Female	26.50	667	43.12	13,705	27.19	236	44.30	4,799
Substance use:								
Alcohol intox. only	54.47	1,371	51.78	16,458	60.94	529	54.31	5,884
Alcohol intox. + illicit	4.65	117	4.15	1,318	4.95	43	4.14	449
Alcohol intox. + pharmaceutical	2.50	63	3.94	1,253	1.96	17	4.96	537
Alcohol intox. + illicit + pharmaceutical	0.24	6	0.34	108	0.46	< 5	0.40	43
Illicit only	6.48	163	8.19	2,604	3.34	29	4.35	471
Illicit + alcohol involved	7.47	188	6.95	2,208	8.18	71	6.05	655
Illicit + pharmaceutical	1.27	32	1.45	460	0.81	7	1.19	129
Illicit + pharma. + alcohol involved	0.68	17	0.70	222	0.81	7	0.56	61
Pharmaceutical only	1.39	35	6.46	2,053	2.42	21	7.10	769
Pharma. + alcohol involved	3.69	93	6.03	1,917	3.11	27	7.13	773

Bolded figures indicate where two sample *t*-tests (for mean age only) or Pearson's chi-squared (χ^2) tests find a statistically significant (< 0.01) group difference.

a. High-alcohol hours include 8:00pm Friday to 5:59am Saturday and 8:00pm Saturday to 5:59am Sunday.

SE = standard error.

likely to involve males (χ^2 (1) = 264.5, $\rho < 0.001$), younger persons ($t = 9.83$, $\rho < 0.001$), and alcohol intoxication only (χ^2 (1) = 6.78, $\rho < 0.001$), compared to attendances that were not aggressive/violent (see Table 3). Similar trends were found in regional locations during HAH, though there were considerable fewer cases compared with metropolitan locations.

3.5. Differences in aggression and/or violence during high alcohol hours by police co-attendance

Attendances involving aggression/violence with police co-attendance during HAH were significantly more likely to involve males (χ^2 (1) = 65.8, $\rho < 0.001$), alcohol intoxication only (χ^2 (1) = 11.6, $\rho < 0.01$), alcohol intoxication combined with pharmaceutical use (χ^2 (1) = 13.0, $\rho < 0.001$), illicit drug use only (χ^2 (1) = 24.6, $\rho < 0.001$),

and pharmaceutical drug use only (χ^2 (1) = 45.3, $\rho < 0.001$) compared to attendances that were not aggressive/violent (see Table 4). A similar pattern was found for attendances that did not involve police.

4. Discussion

Aggression and violence are frequently recorded at ambulance attendances that involve substance use. Clinical records indicate that aggression/violence was recorded in around one in 20 substance-involved ambulance attendances in Victoria over a 5-year period. At attendances involving substance use and where aggression/violence was recorded, individuals were more likely to be younger and male, compared with those attendances where aggression/violence was not recorded. This is consistent with the findings of previous Australian studies of substance-related violence in the general community and with

Table 4

Frequency of aggression and/or violence recorded at ambulance attendances involving substance use in high alcohol hours^(a) according to police attendance, Victoria, January 2012 to January 2017.

	Police attendance				No police attendance			
	Aggression/violence recorded (n = 1,811)		No aggression/violence recorded (n = 9,136)		Aggression/violence recorded (n = 1,516)		No aggression/violence recorded (n = 33,683)	
Mean (SE) age of patient (years)	31.61 (0.28)		32.38 (0.14)		31.91 (0.34)		35.75 (0.09)	
	%	n	%	n	%	n	%	n
Gender:								
Male	73.52	1,383	63.76	5,825	73.15	1,109	54.65	18,409
Female	26.48	498	36.24	3,311	26.85	407	45.35	15,274
Substance use:								
Alcohol intox. only	54.23	1,020	49.92	4,561	58.51	887	53.10	17,887
Alcohol intox. + illicit	4.78	90	3.79	346	4.68	71	4.24	1,428
Alcohol intox. + pharmaceutical	2.76	52	4.62	422	1.85	28	4.07	1,372
Alcohol intox. + illicit + pharmaceutical	0.32	6	0.39	36	0.26	< 5	0.34	115
Illicit only	4.94	93	8.30	758	6.53	99	6.91	2,328
Illicit + alcohol involved	8.19	154	6.69	611	6.99	106	6.73	2,266
Illicit + pharmaceutical	1.28	24	1.54	141	0.99	15	1.34	450
Illicit + pharma. + alcohol involved	0.85	16	0.68	62	0.53	8	0.66	221
Pharmaceutical only	1.91	36	5.63	514	1.32	20	6.89	2,321
Pharma. + alcohol involved	4.09	77	6.93	633	2.84	43	6.13	2,066

Bolded figures indicate where two sample *t*-tests (for mean age only) or Pearson's chi-squared (χ^2) tests find a statistically significant (< 0.01) group difference.

a. High-alcohol hours include 8:00pm Friday to 5:59am Saturday and 8:00pm Saturday to 5:59am Sunday.

SE = standard error.

studies of aggression/violence at ambulance attendances specifically (Heilbronn et al., 2015; Laslett et al., 2011; Miller et al., 2015). The finding underlines the importance of developing preventive measures that can effectively target the substance use and aggressive behaviours of groups more likely to be problematic, such as young adult males.

Importantly, our analysis also shows that certain types of substance use are disproportionately involved in ambulance attendances where aggression/violence was recorded. We found intoxication related to alcohol, in particular, was by far the most prevalent and most likely substance to be involved where aggression/violence was recorded. The magnitude of the harm from alcohol is substantial, with an average of three attendances involving alcohol-related aggression/violence per day over the study period. Further, although our findings show illicit drug use (without alcohol or pharmaceuticals) was among the most frequently recorded types of substance use involved in ambulance attendances, it was not more likely to be involved where aggression/violence was recorded, unless used in combination with alcohol.

The findings pertaining to the disproportionate influence of alcohol on aggressive/violence ambulance attendances is consistent with the large body of research linking alcohol use, exclusively and in combination with other drugs, to aggressive and violent behaviours (Boles and Miotto, 2003). Indeed, an earlier study of cannabis-related ambulance attendances in Melbourne, which found that police co-attendance (as an indicator of aggression/violence) was more likely at ambulance attendances where individuals were cannabis and alcohol affected, but less likely where individuals were cannabis-only affected (Kaar et al., 2015). Our findings are also supported by a recent meta-analysis indicating combined alcohol and illicit drug use increases the likelihood of violence (Duke et al., 2018). Alcohol can be a contributing factor to violence or increases in the severity of aggression/violence, possibly due to intoxicated individuals focusing more on instigative cues in their environment (Leonard and Quigley, 2017) and a reduction in impulse control (Tomlinson et al., 2016). While the relationship between alcohol use and aggression is unequivocal (Parker and Auerhahn, 1998), the association between illicit drug use and aggression/violence is more complex (Tomlinson et al., 2016).

Additionally, we found that aggression/violence was less likely to be recorded where attendances involved pharmaceutical use. This also aligns with the findings from previous research, where police were very seldom required to co-attend pharmaceutical-related ambulance attendances in Melbourne, with the majority of patients female and, thus, less likely to be aggressive or violent (Lloyd and McElwee, 2011).

A key finding of this study is that the likelihood of aggression/violence being recorded is greater in certain contexts. Specifically, we found evidence of a temporal pattern in the frequency of aggression/violence at ambulance attendances, whereby they were more likely to be recorded during HAH. During HAH, we found there was a greater likelihood that individuals at aggressive/violent attendances were male, younger, and alcohol intoxicated, compared to attendances where aggression/violence was not recorded. Our finding that the frequency of alcohol-related violence being recorded is magnified during HAH is consistent with findings from previous Australian studies of violence at ambulance attendances (Heilbronn et al., 2015; Miller et al., 2012). Our findings support arguments for evidence-based policy measures that aim to prevent alcohol-related violence through interventions targeted specifically at HAH. This may include, for example, limiting the trading hours of alcohol outlets, which studies undertaken in metropolitan and regional locations across Australia show can substantially reduce rates of violence late at night (Wilkinson et al., 2016). Importantly, the Australian evidence indicates that, compared with voluntary controls on alcohol outlets, mandatory and well enforced restrictions on the trading hours of alcohol outlets is a key element to the effectiveness of interventions in reducing rates of alcohol-related harm in the population (Miller et al., 2014).

An unexpected finding of our study is that while the frequency of ambulance attendances that involved substance use differed between

geographic locations, the likelihood of aggression/violence being recorded did not differ geographically. In both the group of attendances where aggression/violence was recorded, and the group of attendances where it was not, approximately three quarters of ambulance attendances occurred in metropolitan Melbourne and approximately one quarter occurred in regional Victoria. This contrasts with previous Australian studies that find there is a greater likelihood of substance-related harm, such as rates of alcohol-related crime, violence and injury, in non-metropolitan locations (Coomber et al., 2013; Rowe et al., 2012). Our findings suggest that substance-related aggression/violence is similarly problematic in both metropolitan and regional populations. However, we recommend future analyses investigate this finding in further depth, using case data disaggregated to a smaller geographic level than we have used. Among other things, any such future analyses should take into account any differences between metropolitan and regional populations in their access to, and utilisation of, ambulance services for substance-related medical emergencies.

A key contribution of this study to the wider body of research on substance-related harm is demonstrating the utility of routinely collected ambulance attendance data for measuring the frequency and describing the characteristics of substance-related aggression/violence in the community. As previous Australian studies have highlighted, ambulance attendance data has the potential to provide a valuable adjunct to police and hospital data on alcohol-related violence in the community (Miller et al., 2012). A recent UK study found that between 66 % and 90 % of violent incidents recorded by ambulance services were not found in police data (Sutherland et al., 2017). There are, however, also some limitations to the data used in this study that should be acknowledged and considered when interpreting the study findings. First, there is potential for reporting bias in the data, as it is collected and recorded by ambulance paramedics who are often directly impacted by substance-related aggression/violence from patients and bystanders, and this may influence the quality, consistency and reliability of their record keeping. Second, it should be noted that where paramedics have recorded the involvement of substance use at aggressive/violent incidents, it cannot be assumed that the substance/s directly contributed to the aggressive/violent behaviour of the individual. Further, the current study utilised data from one jurisdiction of Australia only, therefore generalisability may be limited. Another limitation of the data used in this study is the aggregation of aggressive and violent attendances together, which precludes us from differentiating between the nature and severity of aggression and violent behaviours (e.g. verbal threats, physical assault) in our analysis. The data used in this study also lacks details on the role of the patient, bystanders, and paramedics in the aggression/violence. To address this, Turning Point has developed and piloted a detailed violence taxonomy, delineating the type of violence (aggression, threat and physical violence), role of ambulance patient (aggressor, victim) and the relationships of the parties involved (family members, first responders, other known person, stranger); results are forthcoming (Scott et al., 2018). Further research using data containing this important information is therefore recommended, as this would address gaps in current knowledge about the nature of substance-related violence in the community.

5. Conclusion

Preventing substance-related aggression and violence at ambulance attendances represents a major public health and safety challenge for health care providers, governments, and the wider community. This study has shown that, in Australia's second most populous state, Victoria, alcohol use is the leading type of substance use involved in ambulance attendances where aggression/violence is recorded. However, in recent years, preventing harm attributable to alcohol use appears to have been treated as a relatively low priority in alcohol and drug policy development and program investment in Australia (Kyprilou et al., 2018). While efforts should be made to reduce all forms of

substance-related aggression and violence, the findings of this study suggest that governments in Australia should give a renewed priority to reducing the harm from alcohol.

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Contributors

KC, AC, PGM, DS, CH, and SM developed the study, analysis plan, and conducted initial analyses. BV drafted the paper. JW and FM conducted further analyses. All authors contributed to the drafting and critical review of the manuscript, and approved of the final manuscript as submitted.

Declaration of Competing Interest

No conflict declared.

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