Drug and Alcohol Dependence 190 (2018) 46–53

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Full length article

Acute harms associated with inhalant misuse: Co-morbidities and trends relative to age and gender among ambulance attendees

Rose Crossin[a,b,c,*], Debbie Scott[a,c], Katrina G. Witt[a,c], Jhodie R. Duncan[b], Karen Smith[d,e], Dan I. Lubman[a,c]

[a] Eastern Health Clinical School, Monash University, Box Hill, VIC, 3128, Australia
[b] Florey Institute of Neuroscience and Mental Health, Parkville, VIC, 3052, Australia
[c] Turning Point, Eastern Health, Richmond, VIC, 3121, Australia
[d] Ambulance Victoria, Doncaster, VIC, 3108, Australia
[e] Department of Community Emergency Health and Paramedic Practice, Monash University, Frankston, VIC, 3199, Australia

ARTICLE INFO

Keywords:
Volatile solvent abuse
Adolescents
Suicidal behaviour
Mental health
Poly-drug use

ABSTRACT

Background: Inhalant misuse is the deliberate inhalation of products containing toluene to induce intoxication. Chronic harms associated with inhalant misuse are well described; including alcohol and other drug use, mental health disorders, and suicidal behaviours. However, the nature of the acute harms from inhalants and characteristics of people who experience those harms are not well understood. Therefore, this study aimed to identify the acute harms associated with inhalant misuse attendances, and to determine whether these differ by age or gender.

Methods: Ambulance attendance data (Victoria, Australia) from January 2012 to June 2017 were extracted from a database of coded ambulance records. 779 ambulance attendances involving inhalant misuse were identified. Attendance characteristics were categorised by age and gender. Co-morbidities of current mental health, self-harm and suicidal behaviour were assessed, plus the involvement of alcohol and other drugs.

Results: Overall, attendances related to the acute harms of inhalant misuse have decreased over time, although that trend has reversed from January 2015. Gender differentiated the acute harms associated with inhalant misuse. Males were older and presented with concurrent alcohol and other drug use. Females were younger and presented with concurrent suicidal ideation and self-injury. Attendances for under 15-year-olds are increasing; this age group was over-represented, predominantly female, with a strong association with self-injury.

Conclusions: Ambulance presentations related to inhalant misuse were associated with acute and serious harms. This study highlights that the acute treatment needs of those misusing inhalants are complex and may need to be tailored to gender and age groups.

1. Introduction

Inhalant misuse is the deliberate inhalation of products such as glue or petrol, in order to achieve an altered mental state. While only 1% of Australians aged over 14 years report using inhalants in the previous 12 months (AIHW, 2017), the predominant population who misuse inhalants are adolescents. Surveys of tobacco, alcohol, and drug use in Australian secondary school students (aged 12–17) identify that 10.3% report past-year inhalant use, with a greater prevalence among younger adolescents (White and Williams, 2016). In America, equivalent surveys found that 4.7% of 8th graders report past-year inhalant abuse (Miech et al., 2017), and in Canada 6.2% of grade 7 students have used inhalants in the previous year (Boak et al., 2017). For the most part, there is no discernible difference in patterns of use across sexes, except in the 12–13-year-old age group, where females are over-represented (White and Williams, 2016). Worldwide, adolescents are the predominant age group misusing inhalants, and there is a further association with low socio-economic status; inhalant misuse rates are higher in disadvantaged groups such as youth who are homeless, in juvenile justice or remote Indigenous communities (Cairney et al., 2002; Tapia-Conyer et al., 1995; Victorian Department of Human Services, 2005).

Such characteristics make it difficult to collect accurate data about the harms associated with inhalant misuse as population level surveys (such as those cited above) are unlikely to include participants who are

* Corresponding author at: 110 Church Street, Richmond, VIC, 3121, Australia.
E-mail addresses: rose.crossin@monash.edu (R. Crossin), debbie.scott@monash.edu (D. Scott), katrina.witt@monash.edu (K.G. Witt), jhodie.duncan@florey.edu.au (J.R. Duncan), karen.smith@ambulance.vic.gov.au (K. Smith), dan.lubman@monash.edu (D.I. Lubman).

https://doi.org/10.1016/j.drugalcdep.2018.05.026
Received 23 March 2018; Received in revised form 17 May 2018; Accepted 17 May 2018
Available online 28 June 2018
0376-8716/

not in stable housing, are outside the school system, or are younger than secondary school age – populations most likely to engage in inhalant misuse. There is also social stigma associated with inhalant misuse (Perron et al., 2011), which may lead to under-reporting when individuals are asked about this behaviour. Though a limited number of small cohort studies do exist that capture some of these hidden populations, the samples are predominantly male only (Crossin et al., 2017b) or mixed gender cohorts (Doğru et al., 2007; Kunitz, 2008), with cohort data on females sparse despite equivalent levels of inhalant misuse.

Both acute and chronic harms can arise from inhalant misuse. The most severe acute harm is sudden sniffing death, which is heart failure arising from an irregular heartbeat, caused by stress of strenuous activity following inhalant use (Shepherd, 1989). Other acute harms can include asphyxiation or unintentional injuries while intoxicated (Lubman et al., 2006). The chronic harms caused by inhalants are diverse, and include cognitive dysfunction (Cairney et al., 2002), kidney disease (Taher et al., 1974), and growth impairments (Crossin et al., 2017a).

Inhalant misuse also has a strong association with mental health disorders (Sakai et al., 2004), suicidal ideation and behaviour (Howard et al., 2010), and alcohol and drug use (Wu et al., 2008), although it is less clear whether these issues are pre-morbid, are acute harms associated with inhalant misuse, or occur as part of a broader spectrum of risk factors that may arise from socio-economic status / disadvantage in populations where inhalant misuse is more prevalent. In contrast to the existing body of knowledge on chronic harms arising from inhalant misuse, the acute harms associated with inhalant misuse remain poorly defined, and it is not known if mental health disorders, suicidal behaviour, and alcohol and drug use should be considered as acute harms. Furthermore, it is not known if acute harms are experienced across all inhalant users, or are relevant to particular demographics.

Ambulance data provides key information regarding acute harms associated with inhalant misuse, including access to hidden groups that may be under-represented in population level surveys. Indeed, populations where inhalant misuse is prevalent have reduced access to primary health care (Booth et al., 2004; Kang et al., 2003), while only two thirds of individuals treated by paramedics for inhalant misuse are transported to hospital (Cvetkovski and Dietze, 2008), highlighting the under-reporting of inhalant misuse acute harms in other clinical datasets. The use of ambulance data also overcomes issues inherent to self-reporting, because information on the attendances comes not only from the patient, but also the paramedics and other involved individuals.

As such, the aims of the current study were to describe the population characteristics of ambulance attendances related to inhalant misuse, to identify co-occurring mental health symptomology, suicidal ideation and behaviours, and other alcohol and drug use, to determine whether these patterns of co-occurrences differ by age or gender, and to identify predictors for harms that co-occur with inhalant misuse in order to reveal potential high-risk population groups.

2. Methods

Data on ambulance attendances for inhalant misuse were accessed from data collected for the Ambo Project, an ongoing collaboration between Turning Point and Ambulance Victoria. The methods for data collection and coding from the Ambo Project have been previously described (Dietze et al., 1998, 2000; Lloyd and McElwee, 2011), but are outlined here briefly. Data are provided to Turning Point from Ambulance Victoria (AV), as an output of VACIS®, their electronic patient care record system. Ambulance attendances are filtered to identify those with involvement of alcohol, other drugs, or mental health symptomology. This filtered dataset is provided to Turning Point, where case notes are de-identified (any personal names or information is redacted from the notes) and transferred into a custom-designed database where coding is performed by a specialist team of research assistants. Each record is scrutinised by a research assistant and a systematic and validated coding system used to capture information held in the clinical notes. The core criterion used in determining the involvement of a drug or substance is: “Is it reasonable to attribute the immediate or recent (not merely chronic) over- or inappropriate ingestion of the substance or medication as significantly contributing to the reason for the Ambulance Victoria attendance?" The data are regularly assessed for inter- and intra-rater reliability and adherence to well established and validated coding protocols.

For this study, all ambulance attendances in Victoria (January 2012–June 2017) were filtered, and attendances that reported that inhalant misuse was a significant contributor to that attendance were included. To be included, inhalant misuse must be a significant contributor to the attendance; however, other drugs and alcohol may have also been ingested. Patient demographics of age and gender were analysed, as well as their relationship to other categorical variables relative to the characteristics of the attendance (e.g., location of the attendance, police co-attendance) and to potential co-occurring patient issues (e.g., other drug intoxication, current mental health symptomology, and suicidal ideation and/or behaviour, as well as intentional self-injury without clear suicidal motivation). Age groups used were: < 15, 15–29, 30–44, 45–59, and ≥ 60 years of age. Current symptoms of depression, anxiety, psychosis, and other unspecified current mental health (MH) symptomology were aggregated to create a variable ‘Current mental health (MH) symptomology.’ The relationship between categorical variables was analysed using chi-square analysis. Identification of predictor variables for either mental health symptoms or suicide attempt co-occurring with inhalant misuse were identified by logistic regression, with a post-hoc Wald test used to identify significant variables; these outcomes were analysed due to their high frequency of co-occurrence with inhalant misuse. This analysis is done within the inhalant misuse group, such that the ‘exposed’ group is those with inhalant misuse plus co-occurring mental health symptoms or mental health, and the ‘non-exposed’ group is inhalant misuse without those co-occurrences. Trends over time were analysed by aggregation of monthly attendance data into 6-monthly intervals. Due to paramedic industrial action from October 2014 to December 2014, ambulance attendance data was not collected for this period and thus forms a period of missing data for all attendances. To calculate a value for July 2014–December 2014, the attendance rate for Oct–Dec 2014 was imputed from the Jul–Sept 2014 period, to account for the missing 3 months of data. Rates of inhalant attendances per 100,000 population were calculated using Estimated Resident Population (ERP) data sourced from the Australian Bureau of Statistics (ABS, 2017). At the time of writing, ERP data for 2017 was not available, therefore 2016 ERP data was applied to the first 6 months of 2017.

Ethics approval was obtained from the Eastern Health Human Research Ethics Committee. Due to concerns of potential identifiability, where any analysis yielded an $n < 5$ an exact n was not reported, in compliance with the ethics approval. Chi-square tests report both χ^2 and p values. Logistic regression reports an odds ratio with 95% confidence interval, Wald test, and p-values. P values less than 0.05 are considered significant. All statistical analysis was conducted in Stata (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP).

3. Results

Between January 1, 2012 and June 30, 2017, there were 779 ambulance attendances in Victoria, in which inhalant misuse was a significant contributor to that attendance. The occurrences of those attendances over time (reported as attendances per 100,000 population), in total and separated by gender, are shown in Fig. 1, and indicate an overall downwards trend over time, though a potential reversal of that trend is observed from January 2015 onwards. Males represented 440 (56.5%) of all inhalant misuse attendances, and females 329 (42.2%) of all inhalant misuse attendances, with 10 attendances where the person’s