

Research Article

An observational study of cannabis exposures reported to the Poison Information Helpline of the Western Cape

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ABSTRACT

Background: Cannabis has been decriminalised for private use in South Africa in September 2018. This act may potentially lead to an increase of undesirable effects from cannabis exposures.

Objectives: To describe the demographics and characteristics of reported cannabis exposure cases from June 2015 to June 2019.

Methods: This was a retrospective, observational, cross-sectional study of reported cannabis exposures reported to the Poisons Information Helpline of the Western Cape (PIHWC). Data included: demographics; circumstances of exposure; route of exposure; symptom profile and changes in the number of reports made to the PIHWC from June 2015 to June 2019.

Results: A total of 106 database entries were identified. The most common age groups were 20–59 years old (52.8%) followed by under 12 years old (27.3%). There was a threefold increase in cases reported during the period 06/2018 – 06/2019, compared the period 06/2015 – 06/2016. Accidental overuse (40.6%), substance abuse (26.4%) and intentional self-harm (19.8%) were the most reported circumstances of exposure. The most common route of exposure was oral (66.0%) followed by inhalation (26.4%). Central nervous system (75.5%) and gastrointestinal (20.8%) symptoms were commonly reported. Central nervous system symptoms were more commonly reported in children 12 years and younger ($p=0.001$) compared to those over 12 years.

Conclusion: During the study period undesired effects of cannabis were commonly reported after accidental exposures and oral ingestions. Children 12 years and younger are more likely to report neurological symptoms.

Keywords: Cannabis, Toxicology, Paediatrics, Poison centre, Emergency Medicine

INTRODUCTION

In September 2018, South Africa joined many other countries with a landmark constitutional court ruling in favour of decriminalising cannabis for private cultivation and consumption.⁽¹⁾ The introduction of the Cannabis for Private Purposes Bill in 2020 further clarified how consumers can legally use cannabis. Despite being illegal, cannabis had been a popular drug in South Africa for many years.⁽²⁾ Cannabis contains over 240 cannabinoid compounds, many of which have a physiological effect on endocannabinoid receptors. The main cannabinoid compounds contained in cannabis are delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD). THC is responsible for a dose-related psychotropic effect, or the cannabis ‘high.’⁽³⁾ Cannabidiol, however, is commonly used for its health benefits. Health benefits include the treatment of chronic pain, nausea, vomiting, and weight loss in chronic disease.⁽⁴⁾

In May 2019, the South African Minister of Health amended the Medicines and Related Substance Act of 1965, excluding certain formulations of cannabidiol from the list of scheduled medicines. This exclusion provides guidelines regarding the levels of THC and cannabidiol contained in these formulations that do not require to be registered, as well as regulations regarding the health risks associated with its use.⁽⁵⁾ Certain cannabis-based oils and other related health products are easily accessible to consumers without medical prescriptions. The actual concentration in many commercially available cannabis oil brands often differs from the declared content.⁽⁶⁾

The expectation is that changing legislation will lead to the increased use of cannabis products, but this has not been supported by recent international publications.^(7,8) However, there has been an increase in reports of acute cannabis intoxication and other adverse effects made to

health care facilities in countries where cannabis is legal. (9,10) Poison centres in the same geographical area also documented an increase in the number of reported cannabis exposures, in both adult and paediatric populations. (11–13) Poison centres are an integral part of the health care system. They provide a cost-saving benefit and add value by triaging low risk and asymptomatic poison exposures away from emergency departments. (14) They also assist in public health surveillance by studying patterns of reported poisoning. (11,15)

In general, cannabis research is limited, and little has been conducted in South Africa. To gain some insight into the field, we aimed to describe the demographics and characteristics of reported cannabis exposures over a 4-year period.

METHODS

In this retrospective, observational, cross-sectional study, a secondary analysis of the AfriTox™ TeleLog Database (ATD) was conducted. This database is maintained by the Poisons Information Centre, Institute of Child Health, Red Cross War Memorial Children's Hospital, Cape Town, South Africa. The Poisons Information Helpline of the Western Cape (PIHWC) is a joint service provided by two poison centres, one located at Red Cross War Memorial Children's Hospital and the other at Tygerberg Hospital, Belville, and it provides a 24-hour telephonic consultation service. For every case reported to the PIHWC, the following information is captured in the ATD: demographic data including age, gender and location, information regarding the circumstances of the exposure, the severity of the poisoning, recommendations, and advice. Poison exposure is categorised into four levels of severity using the Poisons Severity Score (PSS): (16) 0 – No symptoms or signs related to poisoning, 1 – Mild, transient, or spontaneously resolving symptoms or signs, 2 – Pronounced or prolonged symptoms or signs, 3 – Severe or life-threatening symptoms or signs. The PSS compares favourably to poison centre grading systems used in similar international studies. (11,12) Data entries were captured over 4 years, from 1 June 2015, the inception date of the database, to 30 June 2019 that related to cannabis, dagga, marijuana, or any other derived name of cannabis. Ethical approval for the study (M190904) was obtained from the Human Research Ethics Committee of the University of the Witwatersrand.

Data analysis was conducted in Microsoft Excel (Office 365, version 2112, Microsoft, USA) and R Studio (RStudio Team (2019). RStudio: Integrated Development Environment for R. RStudio, PBC, Boston, MA URL <http://www.rstudio.com>). Categorical data is described using frequencies and percentages. Parametric and non-parametric numbers were determined by measure of skewness, and were described using means and standard deviations, and medians and interquartile ranges, respectively. To describe changes in demographic variables over time, we

divided all data entries into four 12-month periods ranging from July to June of each year starting with June 2015. Changes in categorical data over time and between groups were assessed using the Chi-square test or Fisher's exact test. We considered a p-value of <0.05 to be significant.

RESULTS

All database entries were reviewed for validity. Three double entries and two entries not related to cannabis use were removed. Where reports referenced more than one patient per entry, separate data entries were created for each patient. After review and removal of inaccurate data, there were a total of 106 entries, i.e., cases.

Monosubstance cannabis exposure accounted for 70.8% of reported cases, and the remainder were polysubstance cannabis exposures. The reported gender representation was almost equal: males (50.9%), females (47.2%) and unidentified (1.9%). Ages ranged from 1 to 80 years, with a mean (SD) age of 23.4 (17.6) years. Most reports involved adults over the age of twenty, while only 16.0% of reported cases involved adolescents between the ages of 13 and 19. Children 12 years and younger, with a median (IQR) age of 4 (3), were involved in 27.3% of reported cases. Significantly more children aged 12 years and younger reported adverse effects from monosubstance exposure compared to adults, who were more likely to report polysubstance exposure (Table 1).

There was a threefold increase in cases reported during the period June 2018 to June 2019 compared to the period June 2015 to June 2016. This increase was statistically significant compared to the total increase in cases reported to the PIHWC over the same period ($p < 0.001$) (Figure 1)

Circumstances of exposure were reported as accidental (40.6%), substance abuse/misuse (26.4%), intentional self-harm (19.8%), malicious intent involving another person (4.7%), therapeutic error (4.7%) and unknown (3.8%). The circumstance of exposure was significantly different between monosubstance and polysubstance exposure ($p = 0.0003$). Accidental exposure was more likely to occur in reports of monosubstance exposure, while intentional self-harm was more likely ($p < 0.0001$) to occur in reports of poly-substance exposure (Figure 2.) Accidental exposure and malicious exposure were significantly higher ($p < 0.0001$) in the age group, 12 and younger compared to other age groups (Figure 2).

A Poison Severity Score (PSS) (16) category of 0 (1.9%) or 1 (75.5%) was recorded in most cases. A more severe PSS category of 3 (20.8%) or 4 (1.9%) was recorded in less than a quarter of cases. The PSS was not statistically different between monosubstance and polysubstance exposure groups ($p = 0.8887$) The PSS was statistically different for age groups ($p = 0.0319$) This is due to a larger percentage of category 3 exposure in under 12-year-olds (20,7%) compared to over 12-year-olds (2.59).

Symptoms recorded by the PIHWC were categorised into central nervous system symptoms (the most common

Table 1: Reported cannabis exposure by age group.

Age group	Polysubstance	Monosubstance	Total	Fisher's exact test
Child (1-12)	1 (3.4%)	28 (96.5%)	29 (27.4%)	p = 0.0002
Teen (13-19)	8 (47.1%)	9 (52.9%)	17 (16.0%)	p = 0.0888
Adult (>20)	22 (36.7%)	38 (63.3%)	60 (56.6%)	p = 0.0840
Total	31 (29.3%)	75 (70.8%)	106 (100%)	p < 0.0003

*Data reported as n (%)

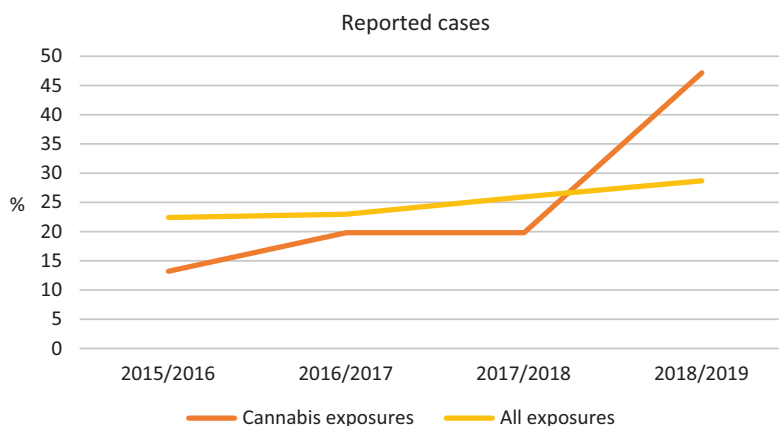


Fig 1: Changes in reported cannabis exposures over the study period

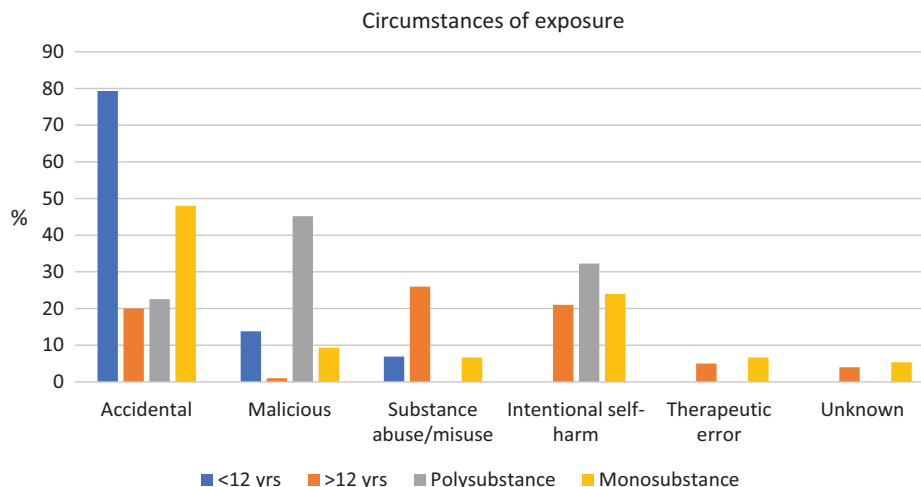


Fig 2: Circumstances of exposure according to age group and use category

category), followed by gastrointestinal and cardiovascular symptoms. (Table 2) Symptom category was not statistically different between the mono-substance group and poly-substance group (p = 0.287). Symptom category was statistically different between age groups (p = 0.0005) due to the high incidence of central nervous system symptoms reported in cases of under 12-year-olds. Neuro-depression was most common in this age group (75.9%), compared to over 12-year-olds where neuro-excitation was the most common central nervous system symptom (66.7%). (Table 2)

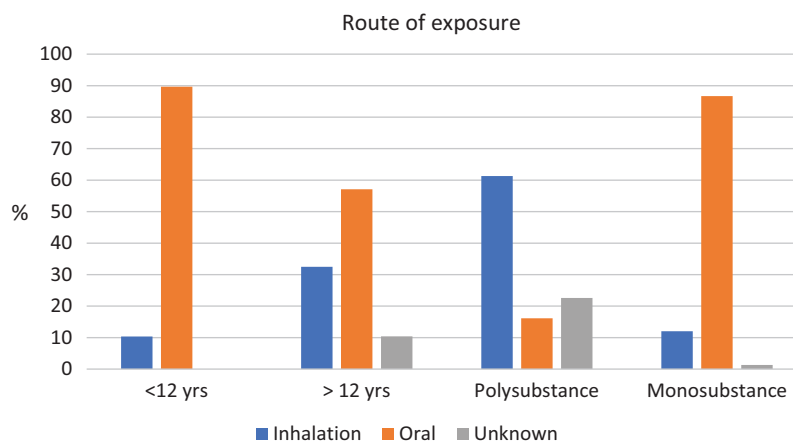
Routes of exposure were most recorded as oral ingestion (66.0%) followed by inhalation (26.4%). A review of the available data found that cannabis was commonly ingested in the form of edible products (48.6%) or oil-based products (45.7%). Monosubstance exposure mostly occurred due to oral ingestion (see Figure 3), while in case reports of polysubstance exposure, cannabis use was significantly more likely to be inhaled (p<0.0001). Reported substances commonly ingested in combination with cannabis were cocaine (48.3%) opioids (38.7%), sedatives (32.2%) and alcohol (22.6%).

Table 2: Symptoms reported by use category and age group

Symptoms	Monosubstance	Polysubstance	p-value	< 12 yrs.	> 12 yrs.	p-value	Total
CNS	58 (77.33)	22 (70.97)	0.148	29 (100)	51 (66.23)	0.0001	80 (75.47)
Neuro-depression	30 (51.72)	8 (36.36)		22 (75.86)	16 (31.37)		38 (47.5)
Neuro-excitation	28 (48.28)	13 (59.09)		7 (24.14)	34 (66.67)		41 (51.25)
Seizure	0 (0)	1 (4.55)	0.395	0 (0)	1 (1.96)	0.659	1 (1.25)
GIT	17 (22.67)	5 (16.13)		3 (10.34)	19 (24.68)		22 (20.75)
Nausea	5 (29.41)	0 (0)		0 (0)	5 (26.32)		5 (22.73)
Vomiting	10 (58.82)	5 (100)		3 (100)	12 (63.16)		15 (68.18)
Abdominal pain	2 (11.76)	0 (0)	0.185	0 (0)	2 (10.53)	0.55	2 (9.09)
CVS	15 (20)	5 (16.13)		1 (3.45)	19 (24.68)		20 (18.87)
Chest pain	1 (6.67)	1 (20)		0 (0)	2 (10.53)		2 (10)
Hypotension	0 (0)	1 (20)		0 (0)	1 (5.26)		1 (5)
Palpitations	8 (53.33)	1 (20)		0 (0)	9 (47.37)		9 (45)
Tachycardia	6 (40)	2 (40)		1 (100)	7 (36.84)		8 (40)
Total	75 (70.75)	31 (29.24)	0.287	29 (27.35)	77 (72.64)	0.0005	106 (100)

*Data reported as n (%)

**CNS – Central nervous system, GIT – Gastrointestinal, CVS – cardiovascular system.

**Fig 3:** comparison of route of exposure by age group and use category

The oral route of exposure was also statistically more common in the age group 12 and younger compared to those older than 12 years ($p = 0.0046$), see Figure 3. Ingestion of food-based cannabis products were commonly reported in children aged 12 years and younger (62.1%). These food-based products were mostly homemade cookies, muffins or scrambled eggs mixed with cannabis. More than one subject per case was reported in 17,0% of cases. Case reports involving children 12 years and younger were more likely to involve more than one subject (44.8%), compared to the rest of the dataset (6.5%). This difference was statistically significant ($p < 0.0001$).

Medical personnel (84.9%) reported most cases outside of normal office hours (77.4%). Reports were recorded from the following provinces: Western Cape (40%), KwaZulu Natal (28%), Gauteng (21%), North-West (4%),

Eastern Cape (2%), Northern Cape (2%), Limpopo (2%), Mpumalanga (1%). Most cases were reported from hospital facilities (67.0%) followed by non-hospital facilities (17.0%). In most cases, the PIHWC advised observation in a hospital (64.2%). We were not able to report on the amount of cannabis used, nor the concentration of THC or cannabidiol as this information was not reliably recorded in the Afritox Telelog Database.

DISCUSSION

In our review of cannabis exposures, there was a substantial increase in the number of cases reported over a 4-year period. There were more cases of cannabis exposure alone compared to cannabis exposure in combination with other substances. In monosubstance exposure, cannabis was more likely to be ingested accidentally by the oral route, whereas

in polysubstance exposure reports, cannabis was more likely to be smoked intentionally. Accidental ingestion of edible cannabis products was a common occurrence in patients aged 12 years and younger, who were significantly more likely to present with neuro-depression and statistically more likely to have a more severe PSS.

A previous review of poison centre data in South Africa in 2013 did not report specifically on cannabis exposure.⁽¹⁵⁾ Although we found an increase in cannabis exposure, we also found an above-average increase in reported cases in 2018/2019. This coincides with the constitutional court verdict decriminalising cannabis for private use.⁽¹⁾ The increase in reported cases may also be attributed to the decreased stigma surrounding cannabis use, increased popularity of cannabis as a health remedy, and increased awareness of the PIHWC as a resource among health practitioners and the general public. An association between the legalisation of cannabis and increased reports of cannabis exposure to poison centres has been shown in the United States of America (30–79%).^(11,12,17,18) The easing of legal restrictions may also lead to less reluctance amongst cannabis users to report exposure and subsequent undesirable effects.⁽¹⁹⁾

We found most cases reported monosubstance exposure, with a Poison Severity Score of 0 or 1. Similarly, a review of cannabis exposures reported to the Israeli Poison Information Centre found mono-substance exposure in up to 83.5% of reported cases, with a no/minor severity recorded in 71.9%.⁽¹³⁾ We found that polysubstance exposure reports were more likely to involve adults intentionally exposed to inhaled cannabis products. Stimulants like cocaine, sedatives and opioids are commonly co-ingested in reported cannabis exposure,^(9,10) and our findings are similar.

In a previous study of patients presenting to the emergency department in Aurora, Colorado, gastrointestinal symptoms, and exacerbation of psychiatric symptoms were commonly associated with cannabis exposure.⁽²⁰⁾ In contrast to this, most cannabis-related exposures reported to the PIHWC had neurological symptoms with varying levels of neuro-depression or neuro-excitation as part of the main complaint. Gastrointestinal and cardiovascular symptoms were less common when compared to neurological symptoms. A study conducted at the Alaska/Oregon Poison Centre shows a similar propensity of neurological symptoms (80.6%) compared to gastrointestinal symptoms (26.5%) and cardiovascular symptoms (14.6%).⁽²¹⁾ The Israeli Poison Information Centre review also found a high incidence of neurological symptoms (60%).⁽¹³⁾ Neurological symptoms after cannabis exposure are concerning and signifies more severe poisoning and increased concern amongst users. This may explain the increased number of reports made to the PIHWC.

We found that neurological symptoms, in particular neuro-depression, to be the most common symptoms in

children reported to the PIHWC. Similarly, the Alaska/Oregon Poison Centre study found neurological (69%) and specifically neuro-depression (52%) commonly reported in paediatric cannabis exposure.⁽²¹⁾ This finding is not isolated to poison centre reviews, as a systematic review of unintentional paediatric cannabis exposure found neurological symptoms like lethargy, ataxia, hypotonia and mydriasis to be the most common findings.⁽²²⁾ Both worsening neurological symptoms and younger age may lead caregivers to be more likely to report exposure in children to the PIHWC.

When cannabis is consumed orally it is more potent, with delayed and erratic absorption compared to inhaled cannabis.⁽³⁾ It is more likely to present with adverse effects like neurological and psychiatric symptoms, whereas inhaled cannabis is more likely to cause gastrointestinal symptoms like cannabis hyperemesis syndrome.⁽²³⁾ In our review, oral ingestion of cannabis was the most common route of exposure. High rates of oral exposure may contribute to the increased number of cases with neurological symptoms reported to the PIHWC.

We found edible and oil-based products to be the most ingested form of cannabis. More than half of confirmed edible exposures occurred in children aged 12 years and younger. The Alaska/Oregon Poison Centre review reported edible exposure in 67% of children aged 12 and younger.⁽²¹⁾ Similarly, a study in Colorado showed a 74% exposure rate to edible cannabis products reported to the regional poison centre amongst paediatric patients.⁽¹²⁾ Edible cannabis poses a novel risk to paediatric populations, who may ingest cannabis edibles like sweets or baked goods or cannabis resin that looks like chocolate.⁽²²⁾ This may further contribute to the high incidence of neurological symptoms reported in children 12 years and younger.⁽¹⁷⁾

In our study most cases were reported after-hours. Similarly, the Oregon/Alaska Poison Centre review found 54% of calls originated from an emergency department.⁽²¹⁾ Although cannabis intoxication is considered mild it is still capable of producing symptoms of intoxication, leading to health care contact.^(13,24) This may signify that people who require health care assistance from cannabis exposure do so as a matter of urgency. Accidental and unintentional exposure to cannabis, especially in the age group 12 years and younger, was common in our study. Studies done in Colorado,^(11,12) Alaska and Oregon⁽²¹⁾ had similar findings. In the age group 12 years and younger, 44% of the reported exposures involved more than one child per case report. This is likely due to imitative behaviour found in paediatric poison ingestions⁽²⁵⁾ which may further influence health-seeking behaviour.

The design of our study has various limitations, however, studies in this field are ethically challenging. Our sample size was small compared to similar studies so it may not adequately represent the current situation in South Africa. A secondary review of an existing database has inherent

limitations such as confounding, measurement, and selection bias. Compared to other studies,⁽²¹⁾ data was collected using methods not specifically tailored towards our study objectives. We were unable to confidently report on the amount and strength of cannabis used, because cases were commonly reported with unquantifiable amounts like one joint, half a cookie, or a fingertip.

CONCLUSION

Our investigation provides a South African perspective of the adverse effects of cannabis exposure, and how it has changed over a 4-year period. As more health benefits from cannabis are reported, its social acceptability will increase and along with it the rate of adverse effects will increase as well. Cannabis use is not without consequences, and it is important for all health care practitioners involved in acute patient care to be aware of the various adverse effects associated with its use. In the age group 12 years and younger, our review suggests an increased risk of accidental oral exposure to cannabis which was associated with an increased risk of adverse neurological effects in this age group. Further research is needed in other areas such as emergency departments as well as the general population to understand the impact of cannabis-related adverse effects in South Africa.

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AUTHOR CONTRIBUTIONS

All authors contributed equally to the creation of this manuscript

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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