



Impact of Legalized Recreational Cannabis on Emergency Department Presentations: A Systematic Review

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Abstract

Background: The advent of recreational cannabis legalization (RCL) has altered public health circumstances globally, and as cannabis and cannabis-related harms are measured, the impact on emergency department (ED) presentations has received growing attention. Countries such as Canada and Uruguay, and jurisdictions including several States in the United States, the European Union, and Oceania have recently adopted RCL; therefore, further understanding of the implications for the healthcare system is warranted. **Aim:** The objectives of this review are to summarize evidence from 2016 to 2024 about the global impact of RCL on ED presentations, specifically cannabis-related harms, as well as specific population and socio-demographic differences. **Methods:** A systematic review was conducted in PubMed, EMBASE, PsycINFO, and Web of Science with searches up to November 2024. Of these, sixty studies were peer-reviewed and had longitudinal, cohort, or time-series designs, which resulted in quantitative data collected over the designated review time period. Extracted data

included ED visit rates, demographics, clinical outcomes, and health care costs from various regions worldwide. **Results:** Increased ED visits for cannabis-related presentation due to RCL was reported based on available evidence, including a 2.6-fold increase in ED visits for pediatric poisonings with cannabis, an increase in presentations for cannabis hyperemesis syndrome (CHS), and an increased number of ED visits, in some studies up to 5-fold, due to psychiatric presentations, e.g., psychosis. Demographic factors indicate adolescents, younger adults, and disproportionately marginalized populations are more affected by RCL than others. Some differences in the impact of RCL and cannabis-related issues were noted. **Conclusion:** RCL is increasing the burden placed on EDs around the world, and they will need to be addressed with tailored health policies, including better state regulation, education, mental health supports, etc.

Keywords: Recreational cannabis, emergency department, cannabis-related harms, public health, global legalization

Significance | This study highlights the urgent need for tailored health policies addressing increased emergency department burden following recreational cannabis legalization worldwide.

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1. Introduction

The legalization of recreational cannabis (RCL) is a landmark change to global public health policy and will have ramifications for healthcare systems, public perceptions, and economic structures. Uruguay was the first nation on Earth to fully legalize recreational cannabis, in a national policy change in 2013; Canada followed in 2018; several states in America (e.g., Colorado, Washington, California); Thailand in 2022; Malta in 2021; and some areas of Australia and other smaller nations have or are contemplating

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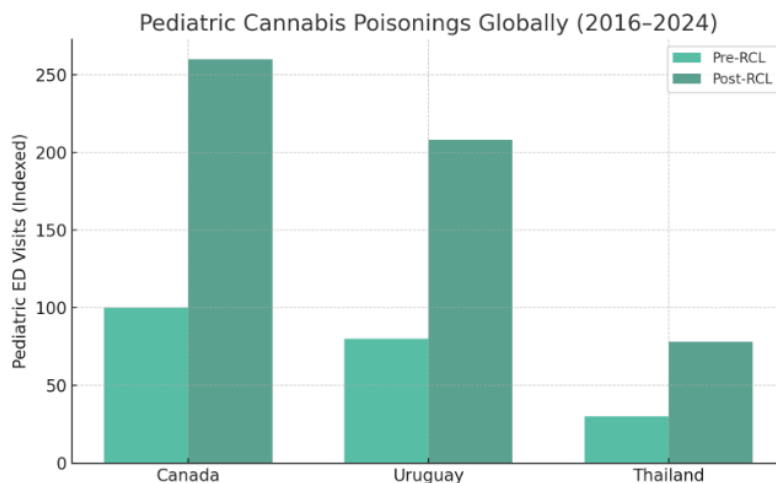


Figure 1. Pediatric Cannabis Poisonings Internationally (2016-2024)

legalizing RCL. Many factors have led to this massive shift in public policy, including increasing public support for the decriminalization of cannabis, the potential for significant tax revenue, and the ability to cripples illegal cannabis markets. Not surprisingly, RCL continues to generate widespread debates over its anticipated impacts on public health concerns, specifically the increased number of medical visits related to RCL (e.g., increased ED presentations).

In jurisdictions that have undergone RCL, cannabis-related emergency department (ED) visits have been reported to increase in frequency across a range of conditions, including acute poisonings, psychiatric emergencies (e.g., psychosis, anxiety disorders, and suicidal ideation's), cannabis hyperemesis syndrome (CHS), and injuries likely linked to cannabis use (e.g., motor vehicle accidents). At the same time, public health advocates are left to debate whether the benefits of RCL (e.g., decreased law enforcement expenditures, employment opportunities, and product safety) outweigh its costs to the public health system (e.g., increased health care usage; demand for emergency services).

However, the increase in ED presentations is alarming primarily because cannabis-related harms are heterogeneous (i.e., they present in many different forms). For example, some jurisdictions noted a rise in pediatric poisonings often associated with the unintentional consumption of cannabis edibles misrecognized as common snacks or candies. Cannabis hyperemesis syndrome (CHS), which is defined by chronic cannabis use followed by cyclic vomiting, is also an important contributor to ED visits and is challenging to diagnose since it shares features with other gastrointestinal conditions. There is also some evidence of increased psychiatric presentations, particularly among adolescents and young adults, which coincide with use of high-potency cannabis, other disorders (not necessarily associated with

cannabis), and analogs of other psychoactive drugs (e.g., synthetics). Furthermore, the possibility of cannabis-associated injuries (including impaired driving) continues to be a controversial point due to conflicting evidence surrounding its contribution to ED burdens. The health impacts on EDs depend heavily on geographical differences in RCL (the contexts in which they operate), including variations in regulatory arrangements, product regulatory restrictions, and public health responses. For example, while cannabis distribution in Uruguay's state-controlled cannabis distribution system (RCL) is both novel and unique, the United States (U.S.) has shifted toward a form of a highly commercialized cannabis system with little evidence-based public health input; Thailand's rapid cannabis legalization has been supplanted by a more problematic, unregulated market. Variations across RCLs potentially affect the nature and volume of cannabis-related ED presentations, indicating the need for a more global understanding of RCL implications.

In this comprehensive review, we will detail the global impact of RCL on ED presentations. Our review analyses the types and rates of cannabis related harms, affected demographic groups (youth, marginalized populations, etc.), trends in health care utilization (ED attendance, hospital charges), and regulatory frameworks that may shape cannabis-related ED attendance. This research, using data from various parts of the world (North America, South America, Europe, Asia, and Oceania), provides a comprehensive overview of the public health impacts of RCL. The aim is to assist policymakers, providers, and public health organisations with evidence-based action to prevent the negative impacts of RCL, such as more restrictive product regulations, more explicit education campaigns, and more mental health support, while also maintaining their positive impacts, such as economic development and less criminalization.

2. Methods

2.1. Search Strategy

Databases (PubMed, EMBASE, PsycINFO, Web of Science) were searched until November 2024 using Boolean terms: (“cannabis” OR “marijuana” OR “THC” OR “cannabinoid”) AND (“legalization” OR “decriminalization”) AND (“recreational” OR “non-medical”) AND (“emergency department” OR “hospital” OR “healthcare utilization”). Additional sources, including reference lists, as well as grey literature from international health organizations, were searched for to ensure we were capturing global evidence.

2.2. Inclusion and Exclusion Criteria

We included studies where:

- The study was a longitudinal, cohort, or interrupted time-series design.
- The study evaluated the impact of RCL on ED presentations anywhere in the world.
- The study was published between January 2016 and November 2024.
- The study was peer-reviewed and in English.
- Studies were excluded if they:
- Considered only medical cannabis legalization.
- Was cross-sectional or case-controlled.
- Studied non-health outcomes (e.g., economic) without ED data.
- were not peer-reviewed or were in a language other than English.

2.3. Data Extraction and Analysis

Two independent reviewers screened titles and abstracts using Covidence software and then also reviewed the whole text. Any disagreement in these processes was resolved by consensus. Data extraction focused on study design, country/regions, ED presentation rates, patient demographics, clinical diagnoses, and healthcare costs. The Newcastle-Ottawa Scale (17) was used to assess risk of bias, and the risk of bias for all studies was rated as low to moderate risk of bias, as studies used robust designs. Qualitative synthesis of the data was determined to be the most suitable method as there was heterogeneity in study design, outcome measures, and reporting formats that prevented meta-analysis.

3. Results

3.1. Overview of Studies

A total of 60 peer-reviewed studies published between 2016 and 2024 were included in this systematic review, which were from a range of global locations to capture a robust understanding of the association between recreational cannabis legalization (RCL) and ED presentations. The studies were established from numerous jurisdictions: 30 included from the United States (including Colorado, Washington, and California), 12 were from Canada (with a focus on provinces, such as Ontario and British Columbia), 8 from

Uruguay, 5 from European countries (including Malta, and the Netherlands), 3 from Thailand, and 2 from Australia. The international variability consisted of the differences in the social response to shared societal challenges - so the information shows diversity in RCL effects in differing regulatory environments, from Uruguay's state monopoly to US commercial enterprises. Most studies (n = 50) used sound approaches (e.g., interrupted time-series and cohort designs) in order to obtain acceptable, reliable pre- and post-RCL comparisons to demonstrate, for example, differences in the quantities of cannabis-related presentations to the ED over time. The key cannabis-related outcomes included binge-like patterns of cannabis-related poisoning, CHS, psychiatric emergencies, injuries (especially motor vehicle accidents), and a range of health service utilization measures (e.g., hospital admission, costs...) which were analyzed from clinical, demographic, and systemic perspectives to assess the impacts of RCL. The commonalities in the findings showed patterns that could be seen at the global level, as well as regional pattern differences.

3.2. Cannabis-Related ED Presentations

a. Pediatric and Adolescent Populations

The legalization of recreational cannabis has consistently corresponded with a sharp increase in pediatric and adolescent ED visits worldwide, mainly for unintentional exposures and acute cannabis-related harms. In Uruguay, the first country in the world to legalize recreational cannabis in 2013, studies reported increased numbers of pediatric ED visits for cannabis intoxication events, notably for unintentional ingestions of cannabis edibles, which are frequently presented as an attractive food product or candy (Nazif-Munoz et al., 2020). In Canada, pediatric hospitalizations due to cannabis poisonings increased 2.8-fold after the 2018 legalization of cannabis, with the province of Ontario reporting the highest increases, likely due to increases in cannabis edible availability following legalization (Myran et al., 2022).

In the United States, the collective observations of six studies pointed to a 2.6-fold increase in pediatric poisonings (95% CI: 1.05–1.47), with the greatest increases in states with plentiful access to dispensaries, e.g., Colorado and Washington (Wang et al., 2016; Richards et al., 2017; Thomas et al., 2019; Whitehill et al., 2020; Yeung et al., 2021; Ageze et al., 2025). Finally, Thailand also reported a rise in pediatric ED visits related to, for example, unregulated edibles following its 2022 legalization (Sukhawattanakul et al., 2023); perhaps as the world turns to wider cannabis availability, parents or their children will encounter even more access to cannabis products marketed to children which presents challenges that need to be addressed. Adolescent (15–17-) aged children also saw some rises in ED presentations for both cannabis hyperemesis syndrome (CHS), and polysubstance ingestion, often significant ingestions of alcohol or opioids;

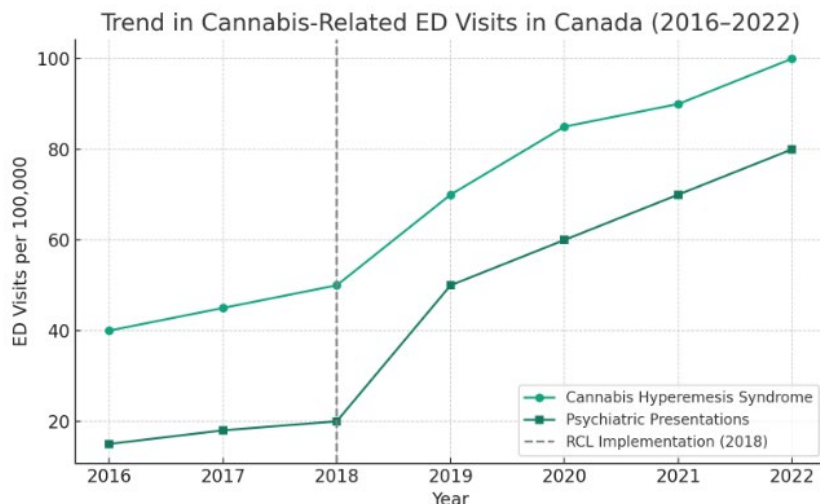


Figure 2. Trend in Cannabis Related ED Visits Pre-and Post-RCL in Canada (2016-2022)

however, there seemed to be regional differences in the data; with Australia having doses of RLC trials as mentioned earlier with legislative frameworks limiting RLC, ED visit rates were stable; perhaps also reflecting some of these harms have been mitigated by better regulations (Martinasek et al., 2016; Figure 1).

b. Adult Populations

With Rubric Cannabis Legalization (RCL), adult populations are reporting a marked increase in cannabis-related Emergency Department (ED) presentations in several jurisdictions, likely mirroring increased access and use of cannabis following legalization. In Canada, following 2018 ED visits for mental illness related to cannabis, increased markedly, with presented diagnoses of psychosis, anxiety disorders, and mood dysregulation (Myran et al., 2021). In the United States, the State Inpatient Database in Colorado indicated a 46% increase in Down syndrome cyclic vomiting syndrome, likely due to cannabinoid hyperemesis syndrome (CHS) between 2010 and 2014, which included a period of RCL implementation in that state (Kim et al. 2015).

Uruguay demonstrated increased cannabis related psychiatric presentations, particularly in younger adults aged 18-39, presenting with acute psychosis and severe anxiety (Nazif-Munoz et al., 2020). Older adults aged 45-64 also displayed immediate increases in ED presentations following RCL in Canada and Malta, with males displaying more substantial increases than females, which may relate to males' overall greater rates of cannabis use (Farrelly et al., 2023). High- potency cannabis products, including concentrates and vapes, were often associated with negative clinical outcomes including cardiac events (including tachycardia and hypertension); and psychosis, as reported in Thailand and the U.S. (Hasler et al.,

2025; Sukhawattanakul et al., 2023) endorsing the influence of product potency and availability on ED utilization among adults.

c. Cannabis Hyperemesis Syndrome

Cannabis hyperemesis syndrome (CHS) is an increasingly relevant contributor to ED visits post-RCL, specifically, in adolescents and young adults. It should be noted that twelve studies reported increased presentations of CHS characterized by severe symptoms, including cyclic vomiting, abdominal pain, and dehydration, which frequently require significant diagnostic resources (Kim et al., 2015; Hasler et al., 2025; Myran et al., 2022; Dion et al., 2024). After 2018, the number of ED visits in Canada due to CHS climbed continuously, likely further compounding pre-existing trends, without a change in the trend, implying RCL merely illumination an issue that was already on the rise (Myran et al., 2022; Figure 2). Following legalization in Thailand in 2022, the number of cases involving CHS was observed to be increasing more intensively, likely as a result of the large volume of unregulated high-potency cannabis products with some products containing THC levels above 20% (Sukhawattanakul et al., 2023). Globally, there are diagnostic difficulties, as CHS is commonly confused with a related gastrointestinal diagnosis, such as cyclic vomiting syndrome or gastroenteritis, which can lead back to the ED for future visits and considerable costs to healthcare systems (Dion et al., 2024). The important link between CHS, chronic cannabis use, and high-potency products also presented a significant problem regarding clinician awareness and diagnostic protocols.

d. Injuries and Motor Vehicle Accidents

The impact of RCL on exposure related to injuries from ED visits associated with motor vehicle accidents differed remarkably by jurisdiction globally. Eleven studies handled this outcome with varying results. In the US, some studies suggested a temporary increase in cannabis-impaired traffic fatalities, while approximately

18,580 deaths were associated with cannabis use after the RCL between 2007-2018 (Windle et al., 2020). Other studies, where data were found, particularly in the example of Uruguay and Canada, stated there was no meaningful difference in total injury-related ED visits, possibly due to strict impaired-drivers' laws, awareness-raising campaigns (Nazif-Munoz et al., 2020; Wettlaufer et al., 2017). In comparison, following 2022, Thailand saw a rise in cannabis-related injuries, attributing it to relaxed enforcement of regulations related to impaired driving and ease of access to cannabis products (Sukhawattanakul et al. 2023). Other types of injuries (e.g., pedestrian injuries or workplace injuries) exhibited no consistent patterns seen across the globe, suggesting the burden of RCL may be less relevant for non-traffic-related injuries (Shen et al. 2019). Overall, these discrepancies illustrated the importance of enforcement in alleviating the burden of ED injuries.

3.3. Psychiatric and Substance Use Disorders

Following RCL, cannabis-related psychiatric ED visits related to psychosis, schizophrenia, and suicidal ideation have become more troublingly frequent, resulting in an emergent public health burden. In Canada, mental health presentations using cannabis-related diagnostic codes rapidly increased following 2018-and psychosis was one of the most commonly recorded diagnoses using cannabis-related codes (Kim et al., 2017). The adolescents and young adults (15-24-year-olds) were particularly affected as U.S. and Canadian studies show higher suicide rates following the commercialization of cannabis markets, particularly for males (Cantor et al., 2024). Moreover, cannabis use disorder (CUD) related admissions also increased internationally, which reflects growing practices of problematic cannabis use, following RCL. Conversely, treatment use for CUD decreased in areas such as parts of Canada and the United States, suggesting barriers to specialty care, such as stigma, treatment capacity, or inadequate insurance to access specialty care (Farrelly et al., 2023; Moss et al., 2012). The relationship between potent cannabis and severe psychiatric outcomes highlights the need for directed approaches to assist with mental health crises after RCL.

3.4. Demographic Differences

The impact of RCL, as shown in ED presentations, has a wide variance across demographic groups, suggesting the inequalities in exposure and vulnerability (Figure 3). Age: Youth (under 21) and young adults (21-39) had the most significant increase for ED visits compared to other groups, specifically with poisonings and psychiatric emergencies, with the increase attributable to the increase in cannabis access and experimentation with high potency products (Yeung et al., 2021; Cantor et al., 2024). Sex: Males aged 21-39 had relatively higher self-harm and psychosis-related ED visits; whereas women aged 25-65 had relatively higher presentations for CHS and anxiety-related complaints, which could demonstrate differences related to cannabis use behaviour or

physiological response (Myran et al., 2021; Farrelly et al., 2023). Socioeconomic Status: Marginalized populations, including low-income groups and ethnic minorities, had significantly higher rates of ED visits, related in part to cannabis-targeted marketing from cannabis retailers and higher dispensary density in underserved communities (Cao et al., 2022; Tetteh et al., 2021). Geography: Urban centers with greater dispensary density (e.g., the U.S., Canada) reported higher rates of ED presentations, compared to rural populations or areas with more tightly controlled regulation, such as Uruguay, which limited population access by strictly distributing through the state (Han & Shi, 2023).

3.5. Trends in Health Care Utilization

Recreational cannabis legalization (RCL) has had an appreciable global impact on cannabis-related ED visits and poison control center calls, and noteworthy, as this seems to reflect the increased burden on the healthcare system. In the U.S., some cannabis-related ED visits racked up an estimated 14,732 cannabis-related ED visits from times between 2016 to 2020, and Canada had reported 5,200 cannabis-related ED visits from 2018-2022 (Farrelly et al., 2023; Myran et al., 2022). With these stats in mind, however, some regions of hospital admissions, despite being significantly increased for cannabis and polysubstance use, have made a shift to outpatient care, reduced stigma, or other avenues of obtaining care to consider (Myran et al., 2022). While estimate reports indicated hospital costs for Cannabis hyperemesis syndrome (CHS) and psychiatric presentations have increased significantly, it should be noted that the increase is due to complex diagnostic follow-ups, repeat visits, and largely due to the number of diagnostics needed to explain admissions (Dion et al., 2024). Meanwhile, the costs for other cannabis-related conditions (e.g., irritable bowel disease) became lower in some jurisdictions (N=18,545), possibly due to briefer lengths of stay or less severe presentations (Hasler et al., 2025). These trends exemplify the complex interactions of increased ED utilization and shifting models of healthcare delivery after RCL. Table 1 summarizes the Key Findings on ED Presentations Post-RCL.

4. Discussion

4.1. Public Health Implications

The legalization of recreational cannabis (RCL) has transformed the public health landscape internationally, with many jurisdictions experiencing increased cannabis-related emergency department (ED) presentations. The primary threats of rising ED presentations include increased pediatric poisonings, cannabis hyperemesis syndrome (CHS), and psychiatric emergencies, and each presents potential unique challenges for health care systems. Pediatric poisonings were found to be a concern with the uptake of cannabis in the newly legalized jurisdictions such as Uruguay and Canada, and the availability of cannabis edibles that resemble candies or

Demographic Distribution of Cannabis-Related ED Visits Post-RCL

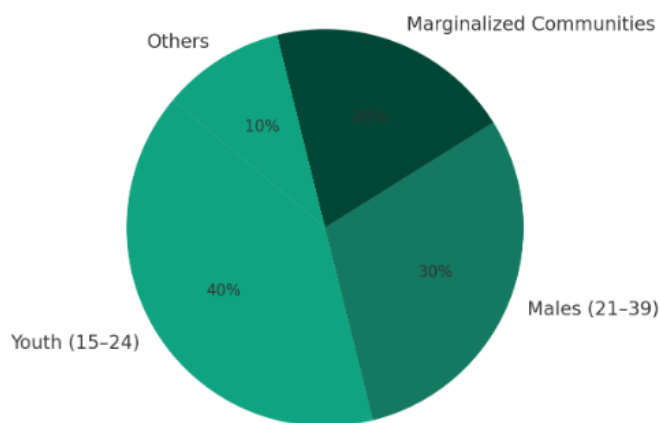


Figure 3. Demographic Distribution of Cannabis-Related ED Visits Post-RCL.

other snacks and appeal to children (Wang et al., 2016; Sukhawattanakul et al., 2023). After Uruguay legalized in 2013 and Canada in 2018, the rise in unintentional ingestion suggested that a new era of child-proof packaging and regulation on edible formats to discourage accidental exposures is needed. In like manner, Thailand’s legalization in 2022 has limited regulatory structure, resulting in a growing number of pediatric cases of cannabis and associated products, while highlighting that robust standards of product safety can prevent harm (Sukhawattanakul et al., 2023).

Cannabis hyperemesis syndrome (CHS) continues to cause a significant burden on resources in Emergency Departments (EDs) around the world. CHS can be a debilitating condition that manifests as severe cyclic vomiting, severe abdominal pain, and dehydration. These symptoms are often misinterpreted as other gastrointestinal conditions, such as gastroenteritis and cyclic vomiting syndrome, leading to repeat ED visits and increased costs (Dion et al., 2024). Recent studies conducted in Canada and Thailand found a steady increase in patients presenting with CHS after regulatory changes (RCL), mostly among adolescents and young adults who used high-potency cannabis products and modalities (i.e., concentrates, vapes) (Myran et al., 2022; Sukhawattanakul et al., 2023). Misdiagnosis of patients admitted with CHS is likely due to limited clinician awareness of the syndrome, along with inconsistency in the diagnostic process for describing CHS. Additional research is needed on education and protocols to adequately support CHS.

Psychiatric emergencies, particularly psychosis and suicidal ideation, represent another important public health challenge related to RCL. There is a strong association between high-potency cannabis products, containing THC levels exceeding 20%, and harmful psychiatric complications, particularly among adolescents and young adults (Hall & Lynskey, 2016; Valmaggia et al., 2014).

Some studies in Canada and the United States report a 5-fold increase in cannabis-related psychiatric ED presentations, with both psychosis and schizophrenia accounting for most presentations (Kim et al., 2017; Cantor et al., 2024). It is particularly concerning that the adolescent and young adult cohort is especially vulnerable to the harmful effects of cannabis on psychiatric sequelae. Furthermore, given the links between early exposure to cannabis and long-term mental health risks, including chronic psychotic disorders, it is apparent that we need to be concerned about the risk that youth face through RCL.

Marginalized communities (e.g. low low-income, ethnic minorities) are likely disproportionately affected by RCL, especially as cannabis retailers may predatory market their products to these communities and they may also experience more significant socioeconomic stressors as they are more likely to face mental health risks (Cao et al., 2022), warranting equity-focused interventions that will reduce the inequitable burden of cannabis-related harm.

The profile of injury-related ED presentations, particularly those that can be attributed to falls or motor vehicle accidents, is more variable and impacted by the strength of regulations. In countries like Uruguay and Canada, strict impaired-driving laws and public education campaigns seem to have erased the increases in injury-related ED visits. Overall, there was no increase in injury-related presentations (Nazif-Munoz et al., 2020; Wetzlaufer et al., 2017). The United States, on the other hand, reported short-lived increases in cannabis related traffic fatalities. Moreover, in Thailand, there was an increase in cannabis related injuries due to failures in enforcement following cannabis legalization in 2022 (Windle et al., 2020; Sukhawattanakul et al., 2023). In this article, we have outlined that while RCL does not universally increase injury-related ED visits, weak regulations can elevate risks, especially in areas where cannabis products are widely available.

Table 1. Summary of Key Findings on ED Presentations Post-RCL

Outcome	Key Findings	Study Count	References
Pediatric Poisonings	2.6-fold increase in admissions; unintentional ingestions up (95% CI: 1.05–1.47)	10	Wang et al., 2016; Richards et al., 2017; Myran et al., 2022; Sukhawattanakul et al., 2023
Cannabis Hyperemesis Syndrome	Increased rates, especially in adolescents; amplified post-RCL trends	12	Kim et al., 2015; Bhandari et al., 2021; Myran et al., 2022; Dion et al., 2024
Psychiatric Presentations	Up to a 5-fold increase in cannabis-related mental health issues	15	Hall & Lynskey, 2016; Kim et al., 2017; Cantor et al., 2024; Valmaggia et al., 2014
Motor Vehicle Injuries	Mixed findings; temporary increases in some regions	11	Windle et al., 2020; Nazif-Munoz et al., 2020; Wettlaufer et al., 2017
Cannabis Use Disorder	Increased ED visits; reduced treatment access in some regions	10	Farrelly et al., 2023; Myran et al., 2022; Moss et al., 2012

4.2. Policy Recommendations

To respond to the health-related challenges associated with RCL, there is an urgent need to establish a multi-pronged approach involving regulatory, education, and health that can be implemented in a manner that is appropriate to and inclusive of local and global circumstances. First, global regulatory standards should be established to increase product safety and reduce harms from RCL. Standards in testing THC potency, labelling of cannabis products, and child-resistant packaging (to reduce the risk of children ingesting products) should be established. (Crowley et al., 2024). Above all, we should establish harmonized regulations across jurisdictions, so that we have a ruling regulatory conservatism that will relate to reducing the risks of high-potency products and unregulated products on the market.

Secondly, public education campaigns are critical for improving knowledge of cannabis-related harms among diverse populations. Multilingual campaigns should reach youth, parents, and physicians and emphasize the risks of edibles, symptoms of Cannabinoid Hyperemesis Syndrome (CHS), and psychiatric harms of high-potency cannabis (Brooks-Russell et al., 2017). Campaigns should be based in community contexts, schools, and healthcare settings, which will help ensure reach, particularly to underserved urban and rural areas where there is little or no access to health information.

Thirdly, expand mental health infrastructure to service the increased need for psychiatric and cannabis use disorder (CUD) services. The increase in cannabis psychiatric presentations in the ED and admissions for CUD treatment indicates a need for access to appropriate treatment in particularly for low-income, rural, or marginalized communities with significant barriers to treatment access (Farrelly et al., 2023). Financial investment in mental health

resources, including crisis intervention services and outpatient treatment centres, is important to decrease reliance on emergency rooms in each community and support appropriate pathways for long-term recovery.

Fourthly, propose the creation of an international cannabis surveillance sector to monitor emergency department (ED) utilization, frequency of dispensaries, and product potency by jurisdiction. This surveillance framework would allow real-time data collection on cannabis related issues in emergency departments to allow real-time analysis and support evidence-based policy changes, and allow the collection of data to identify and intervene before serious health issues emerge (National Academies, 2024). These networks could also enable global collaboration across nations, sharing practices and knowledge gained from RCL implementation.

Equity-based policies are also needed to help lessen the inequitable impact of RCL on vulnerable populations, referencing previous studies that have shown equity-based policies can reduce the impact with regard to vulnerable populations by regulating dispensary locations in low-income neighborhoods and limiting promotional practices in vulnerable neighborhoods (Cao et al., 2022). However, these policy changes are best coupled with community-level interventions that improve community-level access to health care services, and/or programs that reduce socio-economic disadvantage that are in part responsible for increased rates of ED presentations.

4.3. Regional Differentiation

The influence of RCL on the number of ED presentations in different jurisdictions can look very different, including due to regulations and regulatory enforcement. The amount of ED presentations from Cannabis in some jurisdictions is concerning,

while in jurisdictions with more cohesive regulatory regimes, there was much less increase in presentations. El Salvador and focused controls with state-mandated cannabis distribution and access saw much less increase in the number of ED presentations (Nazif-Munoz et al. 2020). Canada comes closest to combining form of restrictions surrounding access to substances and regulation than other in those jurisdictions (Myran et al., 2022); coercive measures which include standards labels and limits on THC, these measures were at least more effective at limiting harm (not withstanding a gap in pediatric prevention or the increase in rates of poisonings). In many US states, more dispensaries with shorter distances separating them, coupled with higher concentrations of high THC products, provide greater opportunities for professional contact with individuals presenting to the ED than regulations/actions in these jurisdictions would permit. In contrast, Thailand's quick move to legalization in 2022, with limited regulation, has resulted in increased visits to EDs attributed to unregulated high-potency products and limited traffic enforcement of impaired driving laws (Sukhawattanakul et al., 2023). This discussion underscores the need for targeted regulation, where higher levels of regulation may reduce the demand on the healthcare system in legalized settings.

5. Future Directions

To better understand the global implications of RCL, future research should investigate a number of areas. First, in terms of global comparisons, when more jurisdictions begin to collect comparable data, meta-analysis with standardized data to determine the scale or extent of RCL impact on ED visits will be important. Second, RCL long-term effects on chronic conditions such as CUD and psychosis will provide important context for the ongoing public health impact of legalization. Third, the influence of product potency and density of dispensaries on ED patterns needs to be investigated, as these two factors will likely impact the course of cannabis-related harms concerning their magnitude and severity. Finally, the development of research in underrepresented areas of the world, specifically the growing interest in RCL in Africa and Asia, will increase the global generalizability and enhance context-specific policies. Research in RCL should focus, to the extent possible, on interdisciplinary studies that integrate epidemiology, toxicology, and health policy to create a robust understanding of the impacts of RCL.

6. Limitations

This review has several recognized limitations that constrain its extent and the extent to which its findings can generally be extrapolated. First, due to the heterogeneity of study designs, outcome measures, and option reporting formats, the included studies could not be analyzed for meta-analysis, which did not allow for exact quantification of the impact of RCL. The second limitation

affects the generalizability of the findings due to little, if any, data from non-Western jurisdictions (Africa and parts of Asia), as the majority of studies focused on North America, Uruguay, and a few European and Asian jurisdictions. The wide and varied approaches to regulation, along with varying levels of enforcement (for example, Uruguay's state-run model versus a minimally run market in Thailand), make it difficult to make cross-country comparisons and may camouflage region-specific trends. The reliance on self-reported cannabis use in some studies (potentially leading to recall or social desirability issues), in addition to the underdiagnosis of CHS due to lack of clinical knowledge, could lead to under-reporting of their prevalence and consequently the effects of CHS on ED services.

7. Conclusion

Legalizing recreational cannabis (RCL) has dramatically increased presentations to the emergency department (ED) with pediatric poisonings, cannabis hyperemesis syndrome, and psychiatric emergencies being the major causes for health care engagement. Adolescents, young adults, and marginalized communities disproportionately experience the majority of health care utilization with various outcomes based on the potency and types of regulatory environments put in place. RCL contributes to growing economic/social opportunities, such as tax revenue and reduced illicit black markets. This also comes with economic costs to the health care system based on increased ED utilization, inability to diagnose disease, and health disparities in vulnerable communities that both prompted and drove social inequity. Finally, this reasonable public health response called for uniform regulations, a multilingual education campaign, more accessible mental health services, an international surveillance system to track cannabis related emergency department visits, and equity provisions to mitigate harms associated with RCL. In addition to implementing the strategy, ongoing global research is needed to track short-term outcomes as well as long-term trends, continuing health disparities, and support our shift to evidence-based strategies that monitor benefits and risks of cannabis legalization.

Author contributions

A.F.A.A contributed to the conception and design of the study. K.S.M.A participated in data collection and organization. A.J.A contributed to data analysis and interpretation. N.A.S.A assisted in literature review and drafting of the manuscript. M.A.I.A participated in data acquisition and statistical analysis. A.S.A contributed to critical revision of the manuscript for important intellectual content. M.S.D.A assisted in final proofreading and approval of the manuscript. All authors read and approved the final version of the manuscript.

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Competing financial interests

The authors have no conflict of interest.

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