What are the mortality rates among patients diagnosed with Cannabis Hyperemesis Syndrome across different age groups and cannabis use patterns?

No deaths were reported in any of the included studies examining CHS patients across age groups ranging from 12 to 50 years with predominantly daily cannabis use patterns, despite substantial healthcare utilization and morbidity, though significant methodological limitations including incomplete follow-up and lack of systematic mortality surveillance prevent definitive conclusions about mortality risk.

Abstract

This systematic review of 10 studies examined mortality rates among patients with Cannabis Hyperemesis Syndrome (CHS) across different age groups and cannabis use patterns. No deaths were reported across any of the included studies, which collectively examined populations ranging from 17 to over 15 million emergency department visits , with follow-up periods extending up to 10 years . CHS predominantly affected young to middle-aged adults, with mean ages ranging from 16.2 to 32.3 years , and was characterized by near-universal daily cannabis use (84-95% of patients) with chronic consumption typically exceeding 2 years before symptom onset . Despite substantial healthcare utilization—averaging 10.9 to 17.9 emergency department visits per patient and hospitalization rates of 33% —no mortality was documented.

However, significant methodological limitations prevent definitive conclusions about mortality risk. Most studies employed passive follow-up with substantial loss to follow-up (only 10-40% of patients in some series) , one study explicitly excluded in-hospital deaths , and no studies used systematic mortality surveillance through death certificates or registries . While documented complications included electrolyte abnormalities , renal dysfunction , and potential cannabis-related arrhythmias , these appear manageable with supportive care including IV fluids and antiemetics . The evidence suggests CHS causes substantial morbidity requiring intensive medical intervention but no documented mortality in young, otherwise healthy populations receiving appropriate acute care. The absence of systematic long-term mortality ascertainment methods across all studies means that rare or delayed deaths, particularly those occurring outside healthcare encounters or related to indirect complications, cannot be definitively ruled out.

Paper search

We performed a semantic search using the query ”What are the mortality rates among patients diagnosed with Cannabis Hyperemesis Syndrome across different age groups and cannabis use patterns?” across over 138 million academic papers from the Elicit search engine, which includes all of Semantic Scholar and OpenAlex.

We retrieved the 50 papers most relevant to the query.

Screening

We screened in sources based on their abstracts that met these criteria:

- **CHS Population**: Does this study involve patients with a confirmed or clinically diagnosed Cannabis Hyperemesis Syndrome?
- **Mortality Outcomes**: Does this study report mortality data or death outcomes in CHS patients?
- **CHS Diagnostic Specificity**: Can CHS patients be clearly distinguished from other cannabis-related conditions in this study?
- **Study Design**: Is this study an observational study (cohort, case-control, cross-sectional), case series with ≥10 patients, systematic review, or meta-analysis?

- **Follow-up Duration**: Does this study provide adequate follow-up (≥30 days) OR report in-hospital mortality?
- **Age-Stratified Data**: Does this study provide age-stratified data or age group analysis?
- **Human Study**: Is this a human study (not an animal study, in vitro study, or mechanistic study)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Mortality Outcomes**:

  Extract all mortality-related data including:

- Number of deaths during study period
- Total sample size for mortality calculation
- Mortality rate (percentage or per 1000 patient-years)
- Cause(s) of death if reported
- Time from CHS diagnosis to death
- Any deaths during acute episodes vs between episodes
- Whether deaths were deemed CHS-related, cannabis-related, or unrelated
- If no deaths occurred, state 'No deaths reported' and note follow-up duration

- **Age Group Analysis**:

  Extract age-related mortality data including:

- How age groups were defined (e.g., 18-25, 26-35, etc.)
- Age-specific mortality rates if provided
- Mean/median age of patients who died vs survived
- Age range of study population
- Whether age was identified as a mortality risk factor
- Any age-related patterns in CHS severity or outcomes

- **Cannabis Use Patterns**:

  Extract detailed cannabis use characteristics including:

- Duration of cannabis use before CHS diagnosis
- Frequency of use (daily, weekly, etc.)
- Type of cannabis products used (flower, concentrates, edibles)
- THC potency/concentration if reported
- Method of consumption (smoking, vaping, edibles)
- Cannabis use patterns among patients who died vs survived
- Any relationship between use patterns and mortality risk

- **Follow-up Duration**:

  Extract information about study timeline including:

- Total follow-up period for mortality assessment
- Mean/median follow-up time per patient

- Loss to follow-up rates
- Whether follow-up was active or passive
- Method used to ascertain mortality (medical records, death certificates, registries)
- Any differences in follow-up between age groups or use pattern groups

- **Study Design**:

  Extract study methodology including:

- Study type (retrospective cohort, prospective cohort, case series, etc.)
- Setting (single center, multi-center, population-based)
- Data source (medical records, registries, surveys)
- CHS diagnostic criteria used
- Inclusion and exclusion criteria
- Whether mortality was a primary or secondary outcome

- **Sample Characteristics**:

  Extract key population demographics including:

- Total sample size
- Age distribution (mean, median, range, standard deviation)
- Sex/gender distribution
- Race/ethnicity if reported
- Geographic location/region
- Healthcare setting (emergency department, inpatient, outpatient)
- Any baseline comorbidities or risk factors

- **CHS Severity**:

  Extract indicators of CHS severity including:

- Number of CHS episodes per patient
- Severity scoring if used
- Hospitalization rates and duration
- ICU admissions
- Complications reported (dehydration, electrolyte abnormalities, renal dysfunction)
- Treatment intensity required
- Whether severity was associated with age or cannabis use patterns

- **Confounding Factors**:

  Extract potential confounders for mortality including:

- Comorbid medical conditions
- Mental health conditions
- Substance use disorders (alcohol, other drugs)
- Socioeconomic factors if reported
- Access to healthcare
- Treatment compliance
- Other factors the authors identified as affecting outcomes

Results

Characteristics of Included Studies

The systematic review identified 10 studies examining CHS patients, with publication years ranging from 2011 to 2025. Full texts were available for 5 of the 10 studies, while 5 were available only as abstracts. The studies employed diverse methodological approaches and varied considerably in sample size and geographic scope.

Study	Full text retrieved?	Study Type	Sample Size	Setting	Geographic Location	Follow-up Duration
K. Elkin et al., 2019	No	Case series	290	Single center ED	Detroit, Michigan	3-year study period (2014-2016)
J. Quiros et al., 2021	No	Retrospective case series	34	Single center inpatient	St. Petersburg, Florida	10 years (2007-2016)
D. Foster et al., 2020	Yes	Retrospective cohort	242 screened, 39 confirmed CHS	Multi-center (2 tertiary-care EDs)	Not specified	April 2014-March 2019
R. Wightman et al., 2023	No	Prospective observational cohort	Not specified	Single center ED	Not specified	At least 2 weeks for cannabinoid testing
D. Zimmer et al., 2019	Yes	Retrospective observational	17	Multi-center (3 medical centers)	United States	2010-2015
J. Zhu et al., 2020	Yes	Systematic review	24 patients from 21 articles	Literature review	Not specified	Not specified
Meera Shah et al., 2024	No	Retrospective cohort	125	Single center inpatient	Not specified	2015-2022
Akari Miki et al., 2025	No	Retrospective cohort	>15 million ED visits	Population-based	Massachusetts	9 years (2012-2021)
Douglas A. Simonetto et al., 2011	Yes	Case series	98	Single center tertiary care	Multi-state (28 states and Canada)	Not specified for full cohort; follow-up available for 10 patients
C. Sorensen et al., 2016	Yes	Systematic review	211 patients from cumulative synthesis	Literature review	Not specified	Not specified

The studies represented diverse methodological quality and scope. Two systematic reviews synthesized data from

multiple case reports and case series, while the remaining eight were primary studies. Sample sizes ranged from 17 patients in a small multi-center series to over 15 million emergency department visits in a population-based study. Most studies were conducted in the United States, with settings including emergency departments , inpatient units , and tertiary care centers .

Mortality Outcomes

Across all 10 studies examining CHS patients, no deaths were reported during the study periods or follow-up intervals. In the Elkin et al. study, patients with in-hospital mortality were explicitly excluded from the analysis , but no further details were provided about these excluded deaths or their relationship to CHS. The remaining studies either explicitly stated no deaths occurred or did not mention mortality as an outcome .

The absence of reported deaths occurred despite substantial follow-up periods in several studies. Lonsdale et al. followed patients over a 10-year period (2007-2016) , Foster et al. tracked patients for 5 years (April 2014-March 2019) , and Miki et al. examined 9 years of emergency department data (2012-2021) . However, most studies provided limited information about systematic mortality ascertainment methods , and follow-up in many cases was passive, relying on existing medical records rather than active patient tracking .

The largest case series by Simonetto et al. included 98 patients but noted that follow-up was available for only 10 patients (10%) , highlighting significant limitations in long-term outcome ascertainment. Similarly, Sorensen et al.'s systematic review found that follow-up was documented in only 40.2% of patients (85 out of 211) , indicating substantial loss to follow-up that could obscure mortality events.

Clinical Characteristics by Age Group

The included studies demonstrated considerable heterogeneity in age distributions across different populations. CHS predominantly affected young to middle-aged adults, with mean ages ranging from 16.2 years in a pediatric emergency department study to 32.3 years in a tertiary care setting.

Study	Age Range	Mean/Median Age	Age Group Focus
K. Elkin et al., 2019	>18 years	Mean: 31 years	Adult ED patients
J. Quiros et al., 2021	13-20 years	Median: 17 years	Adolescents and young adults
D. Foster et al., 2020	12-17 years	Mean: 16.2 years (SD 0.85)	Pediatric population
Meera Shah et al., 2024	Not specified	Mean: 18.06 years (SD 1.41)	Pediatric CHS patients
Akari Miki et al., 2025	18-34 years experienced fastest rise	Not specified	Young adults
Douglas A. Simonetto et al., 2011	14-48 years	Mean at evaluation: 32.3 years; Mean at symptom onset: 25.3 years	All patients <50 years
C. Sorensen et al., 2016	IQR: 22-34 years	Median at diagnosis: 28 years	Adults

Three studies specifically examined pediatric and adolescent populations. Foster et al. focused exclusively on patients aged 12-17 years with a mean age of 16.2 years , while Lonsdale et al. examined patients aged 13-20 years with a

median age of 17 years . The earliest reported CHS case was in a 15-year-old patient . Miki et al.'s population-based study found that individuals aged 18-34 years experienced the fastest rise in CHS prevalence, with young adults, Hispanic individuals, Black individuals, and males having the overall highest 10-year prevalence .

In adult populations, CHS typically presented in the third decade of life. Simonetto et al. reported a mean age at symptom onset of 25.3 years, with a mean age at evaluation of 32.3 years , suggesting a gap between symptom development and diagnosis. Sorensen et al.'s systematic review found a median age at diagnosis of 28 years (IQR 22-34 years) . Notably, all patients in the Simonetto series were younger than 50 years of age , and age younger than 50 was proposed as a supportive diagnostic criterion .

Cannabis Use Patterns

Cannabis use patterns among CHS patients demonstrated remarkably consistent features across studies, characterized by chronic, heavy, daily consumption over extended periods.

Duration of Cannabis Use

The duration of cannabis use before CHS symptom onset was substantial in most patients. In Simonetto et al.'s series, 68% of patients used cannabis for more than 2 years before symptom onset, with duration ranging from 4 months to 27 years . Sorensen et al.'s systematic review found that 36.3% of patients used cannabis for 2-5 years, 16.8% for 6-10 years, and 21.8% for 11 years or more before developing CHS . All pediatric patients in Foster et al.'s study reported at least 6 months of heavy use , and the Rome IV diagnostic criteria specify symptom onset at least 6 months prior to diagnosis .

Frequency and Intensity of Use

Daily cannabis use was nearly universal among CHS patients. Foster et al. reported that 89% of pediatric patients used cannabis at least daily, with a mean consumption of 1.30g per day (SD 1.13g/day) . Simonetto et al. found that 95% of patients used cannabis more than once weekly and 59% used it daily , while 70% reported more than 7 episodes per year . Wightman et al.'s prospective study found that 84% of patients reported using cannabis more than once per day, with a median of 3 times per day on weekdays and 4 times per day on weekends .

Sorensen et al.'s systematic review provided detailed frequency data across multiple studies: 23.7% of patients used cannabis more than daily, 47.9% used it daily, and 19.4% used it weekly . The median age of onset of cannabis use was 16 years , indicating initiation during adolescence. Zimmer et al.'s diagnostic criteria specified a history of daily cannabis use as a requirement for diagnosis .

Cannabis Use Disorder and Withdrawal

Wightman et al. reported that hazardous cannabis use was universal among participants in their prospective cohort, with high cannabis use disorder scores across all patients . The mean cannabis withdrawal discomfort score was 13, indicating clinically significant rates of cannabis withdrawal symptoms with cessation of use . Despite this, most participants (79%) had previously tried to stop cannabis use, but only 13% had sought treatment .

Zhu et al.'s systematic review noted that 21% of adolescent CHS patients had a history of anxiety and depression , while Foster et al. found that 69% of pediatric CHS patients had at least one psychiatric comorbidity . The high prevalence of psychiatric comorbidities suggests that mental health factors may play an important role in cannabis use patterns and CHS development .

Healthcare Utilization and Severity Indicators

CHS patients demonstrated substantial healthcare utilization burdens and presented with severe symptoms requiring intensive management.

Emergency Department Utilization

Elkin et al. reported that CHS patients averaged 10.9 emergency department visits in a two-year period for nausea or abdominal pain symptoms , while Zimmer et al. found that patients had an average of 17.9 ED visits before the diagnosis of CHS was made . Foster et al. noted that 62% of pediatric patients had another visit to the ED within 30 days (prior to or post sentinel visit), with 59% of these visits for similar symptoms . This pattern of repeated ED visits indicates both the cyclic nature of symptoms and potential challenges in diagnosis and management.

Hospitalization and Treatment Intensity

Hospitalization rates were substantial across studies. Elkin et al. reported that 33% of CHS patient visits led to admission , while Zimmer et al. documented 58 total hospital admissions across their 17-patient cohort . Foster et al. found that 87% of pediatric patients were triaged as CTAS-2 or CTAS-3, indicating moderate to severe symptoms .

Treatment intensity was high, with 89% of pediatric patients receiving treatment in the ED according to Foster et al. . Of these, 81% received anti-emetics, 68% received intravenous fluids, and 22% received analgesics . Ondansetron was the most commonly used anti-emetic, administered in 90% of cases in the Foster study and identified as the most prevalent medication in the Elkin study . Normal saline was the most frequently used IV fluid (80%) .

Diagnostic Workup and Costs

The economic burden of CHS was substantial, particularly when diagnosis was delayed. Approximately 75% of CHS patient visits in the Elkin study required laboratory testing, 10% obtained computed tomography scans, and 33% led to admission . Foster et al. reported that investigations included venous blood gas (30%), pregnancy testing in females (84%), liver enzymes (57%), pelvic or abdominal ultrasound (19%), abdominal X-ray (19%), and CT head (5%) . However, imaging was obtained in 36% of all patients, and only 2.4% had abnormalities .

Zimmer et al. calculated that the total cost for combined ED visits and radiologic evaluations averaged $76,920.92 per patient . Sorensen et al.'s systematic review found that the median charge for ED visits and hospital admissions was $95,023 , highlighting the substantial financial impact of CHS on the healthcare system.

Clinical Complications

While specific complications were inconsistently reported across studies, Sorensen et al. noted moderate to severe dehydration and acute renal failure as complications of CHS . Shah et al. found that CHS patients had lower mean serum potassium (3.62 vs 3.88, $p<0.001$) and greater mean serum creatinine (0.83 vs 0.63, $p<0.001$) compared to patients with cyclic vomiting syndrome , suggesting electrolyte abnormalities and potential renal dysfunction. The average systolic blood pressure was also significantly greater in CHS patients (124.46 vs 118.55, $p=0.032$) .

Synthesis

The complete absence of reported mortality across 10 studies examining CHS patients, despite follow-up periods extending up to 10 years and population-based surveillance of over 15 million ED visits , strongly suggests that CHS,

while causing substantial morbidity and healthcare utilization, is not directly associated with significant mortality. However, several methodological considerations require careful interpretation.

Limitations in Mortality Ascertainment

The lack of reported deaths must be interpreted in light of significant methodological constraints. Most studies employed passive follow-up relying on existing medical records rather than active mortality surveillance using death certificates or registries. Loss to follow-up was substantial in several studies—Simonetto et al. had follow-up available for only 10% of patients , and Sorensen et al. documented follow-up in only 40.2% of cases . This incomplete ascertainment means that deaths occurring outside the healthcare systems studied, particularly deaths related to complications occurring between healthcare encounters, would not be captured.

The exclusion of patients with in-hospital mortality in the Elkin study is particularly noteworthy, as it created a survival bias that prevented any assessment of acute mortality during CHS episodes. While no details were provided about these excluded deaths or their relationship to CHS, the explicit exclusion criterion suggests that deaths during hospitalization may occur, though their frequency and etiology remain unknown.

Potential for Delayed or Indirect Mortality

CHS causes severe, recurrent vomiting and dehydration that could theoretically lead to complications including electrolyte imbalances, renal dysfunction, aspiration, esophageal tears, and arrhythmias. Shah et al. documented significant electrolyte abnormalities with lower potassium (3.62 vs 3.88) and elevated creatinine (0.83 vs 0.63) in CHS patients compared to those with cyclic vomiting syndrome. Sorensen et al. reported cases of moderate to severe dehydration and acute renal failure . These complications, while potentially serious, appear to be manageable with appropriate supportive care including IV fluids , as evidenced by the lack of reported deaths.

Quiros et al. highlighted an important but under-recognized risk: arrhythmias associated with cannabis use, which are described in both adults and adolescents . Cannabis users with depressive symptoms were 1.4 times more likely to develop arrhythmia . Given that 69% of pediatric CHS patients had psychiatric comorbidities and 21% of adolescent patients had histories of anxiety and depression , this represents a potential pathway for mortality that may not have been adequately captured in studies focused on CHS episodes rather than long-term outcomes.

Healthcare System Burden Without Mortality

The paradox of CHS—substantial healthcare burden without documented mortality—can be explained by several factors. First, the cyclic nature of symptoms means patients typically recover between episodes, preventing cumulative deterioration. Second, most patients present to emergency departments during acute episodes , where they receive appropriate supportive care including IV fluids and anti-emetics before complications become life-threatening. Third, the young age of most CHS patients (mean ages 16-32 years across studies) means they generally lack significant comorbidities that might compound the physiological stress of severe vomiting episodes.

The substantial healthcare utilization—averaging 10.9 to 17.9 ED visits per patient with hospitalization rates of 33% and average costs exceeding $76,000 per patient —demonstrates that CHS causes significant morbidity requiring intensive medical intervention. However, this aggressive management may be precisely what prevents progression to fatal complications.

Implications for Clinical Practice

The absence of reported mortality should not lead to complacency in managing CHS. The consistent findings of electrolyte abnormalities , renal dysfunction , and severe dehydration indicate that CHS can cause serious physiological derangements requiring prompt medical attention. The high rate of psychiatric comorbidities and potential for cannabis-related arrhythmias suggest that comprehensive assessment and follow-up are warranted.

The universal finding of high cannabis use disorder scores combined with low treatment-seeking rates (only 13% sought treatment) despite most patients attempting to quit highlights a critical gap in care. Cannabis cessation remains the only definitive treatment for CHS , yet the substantial healthcare burden from repeated ED visits suggests that cessation is rarely achieved. The lack of systematic referral to substance abuse counseling or psychiatric services represents a missed opportunity to address both the underlying cannabis use disorder and associated mental health conditions.

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