# Cannabis Use Disorder and All-Cause Mortality in Canada: A Population-Based Cohort Study Using Linked Survey and Vital Statistics Data

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# Abstract

**Background:** Evidence concerning the association between cannabis use disorder and mortality remains limited and has primarily arisen from treatment-based, hospital-based, or administrative cohorts. We examined the association between lifetime cannabis use disorder and all-cause mortality in a nationally representative Canadian household cohort.

**Methods:** We conducted a population-based cohort study of respondents aged 15 years or older from the 2012 Canadian Community Health Survey–Mental Health linked to the Canadian Vital Statistics Death Database. Lifetime cannabis use disorder was defined as DSM-IV cannabis abuse or dependence assessed using the World Mental Health Composite International Diagnostic Interview. Survey-weighted Cox proportional hazards models estimated associations with all-cause mortality through December 31, 2017. The primary model adjusted for age and sex.

**Results:** Respondents with lifetime cannabis use disorder were younger and more likely to be male than respondents without the disorder. Crude mortality was lower among respondents with cannabis use disorder than among those without it (1.61% versus 3.69%). The unadjusted hazard ratio was 0.63 (95% CI 0.35–1.15). Adjustment for age reversed the direction of the association (HR 1.58, 95% CI 0.87–2.85). In the primary age- and sex-adjusted model, lifetime cannabis use disorder was associated with an HR of 1.32 (95% CI 0.71–2.43). Adjusted predicted probabilities of death were 4.59% (95% CI 2.13–7.06) among respondents with cannabis use disorder and 3.52% (95% CI 3.23–3.81) among those without it. Cause-specific estimates could not be released because event counts did not meet Statistics Canada disclosure requirements.

**Conclusions:** Lifetime cannabis use disorder was not associated with a statistically distinguishable increase in all-cause mortality during approximately 5.5 years of follow-up, although the adjusted estimate remained compatible with a potentially meaningful elevation in risk. Differences from hospital-based estimates may reflect variation in disorder severity, recency, healthcare engagement, and case ascertainment.


# INTRODUCTION

Cannabis use disorder (CUD) is associated with psychiatric comorbidity, functional impairment, injury, cardiovascular morbidity, and increased healthcare utilization [1–5]. These consequences have assumed greater public health importance as cannabis exposure has increased and legal markets have expanded [6]. Canadian household surveys indicate substantial growth in past-year cannabis use over time, including a marked increase following legalization of non-medical cannabis [7, 8]. However, the long-term health consequences of CUD, including its association with premature mortality, remain incompletely characterized [9].

The available mortality literature is heterogeneous in both exposure definition and case ascertainment [2, 10–12]. Earlier general-population cohort studies typically examined self-reported cannabis exposure

rather than diagnostically defined CUD [13, 14]. Studies of Swedish conscripts and United States healthcare enrollees found crude associations between cannabis use and subsequent mortality that were attenuated after adjustment for demographic, social, or behavioural factors [14]. More recently, a UK Biobank analysis found that heavy lifetime cannabis use was associated with cardiovascular mortality among women, although associations with all-cause and cancer mortality were imprecise and varied by sex and tobacco-use status [15]. A subsequent systematic review and meta-analysis reported an overall association between cannabis use and all-cause mortality but identified substantial heterogeneity, low certainty of evidence, and important differences according to study design and population [10]. Collectively, these studies suggest possible mortality risk associated with cannabis exposure but do not directly estimate the prognosis of people meeting diagnostic criteria for CUD.

Studies specifically examining CUD have generally identified cases through treatment or healthcare contact. A Danish national cohort of 6,445 people entering treatment for cannabis-related problems reported mortality almost five times that expected in the age- and sex-standardized general population, with particularly elevated mortality from accidents, suicide, and natural causes [16]. In Northern Italy, excess mortality was observed among people receiving treatment for CUD both with and without co-occurring alcohol use disorder, although mortality was substantially greater when alcohol use disorder was also present [17]. More recently, a population-based Ontario study found that people receiving incident hospital-based care for CUD had an adjusted 2.79-fold higher five-year mortality risk than matched members of the general population, with especially elevated risks of suicide, trauma, drug poisoning, and lung cancer [8]. These findings establish hospital-identified CUD as a marker of substantial mortality risk, but treatment and hospital cohorts preferentially capture clinically recognized disorder, acute complications, greater comorbidity, and more intensive healthcare engagement.

Beyond mortality, administrative studies indicate that clinically documented CUD is associated with adverse medical outcomes that may contribute to premature death. In Alberta, adults with administratively identified CUD experienced an approximately 57% higher risk of incident cardiovascular disease than matched individuals without documented CUD [18]. Other studies have examined perioperative myocardial infarction, pulmonary embolism, stroke, asthma, heart failure, and cancer survival, but their findings have varied across clinical populations and outcomes [19–24]. Interpretation of this literature is complicated by substantial heterogeneity in administrative case definitions [25]. A systematic review of 56 studies found that most relied on one or more International Classification of Diseases codes, with considerable variation in healthcare settings, encounter thresholds, and observation periods; none reported empirical validation of the applied CUD case definition [26]. Administrative data may therefore preferentially identify severe or healthcare-engaged cases while missing milder, remitted, untreated, or unrecognized disorder [27].

Population surveys provide a complementary approach by using standardized diagnostic assessments independently of clinical recognition or healthcare contact. When linked to vital statistics, these surveys permit longitudinal outcome ascertainment in nationally representative household cohorts. Canadian Community Health Survey linkages have previously been used to examine mortality associated with

major depressive episodes, eating disorders, binge drinking, community belonging, and other psychiatric, behavioural, and social exposures [28–32]. These studies demonstrate the feasibility and analytic value of combining standardized baseline survey measures with objective mortality records. They also show the importance of age and other sources of confounding: for example, Canadian analyses of major depressive episodes and eating disorders found substantially different mortality associations after demographic adjustment than in crude analyses [33–36].

We used the 2012 Canadian Community Health Survey–Mental Health linked to the Canadian Vital Statistics Death Database to examine the association between lifetime CUD and all-cause mortality in the Canadian household population. CUD was identified using a combined lifetime DSM-IV cannabis abuse-or-dependence measure derived from the World Mental Health Composite International Diagnostic Interview. We hypothesized that lifetime CUD would be associated with greater mortality after adjustment for age and sex. We anticipated that the association would be smaller than estimates from treatment- and hospital-based cohorts because survey ascertainment captures a broader and more heterogeneous spectrum of disorder, including past, remitted, untreated, and less severe cases.

# METHODS

## Study Design and Data Source

We conducted a population-based cohort study using the 2012 Canadian Community Health Survey–Mental Health (CCHS-MH) linked to the Canadian Vital Statistics Death Database (CVSD) [37, 37–41]. The CCHS-MH was a nationally representative survey of people aged 15 years or older living in private dwellings across Canada's ten provinces [42–44]. It uses a multistage, stratified sampling design and includes standardized assessments of mental and substance use disorders using the World Mental Health Composite International Diagnostic Interview (WMH-CIDI) [45, 46]. The survey excludes individuals living on First Nations reserves and other Indigenous settlements, full-time members of the Canadian Armed Forces, institutionalized populations, and residents of selected remote regions of Canada [42, 43, 47–49]. Respondents who consented to record linkage were eligible for inclusion. Linkage between the CCHS-MH and CVSD was performed by Statistics Canada using probabilistic record linkage within the Social Data Linkage Environment [32, 37, 37–39]. Follow-up began on the survey interview date and continued until death or administrative censoring on December 31, 2017, whichever occurred first [38–40, 50].

## Exposure

The exposure was lifetime cannabis use disorder (CUD), defined using the combined DSM-IV cannabis abuse-or-dependence variable available in the linked CCHS-MH analytical file. The variable was derived from the WMH-CIDI according to DSM-IV diagnostic criteria [45, 46, 51]. Respondents meeting lifetime criteria for either cannabis abuse or cannabis dependence were classified as having lifetime CUD [27,

52]. Separate measures of cannabis abuse, cannabis dependence, disorder severity, and current CUD were not available in the linked file [38, 40, 53]. Accordingly, the exposure represented a lifetime history of DSM-IV cannabis abuse or dependence rather than current CUD at the time of survey participation [25, 54].

## Outcomes

The primary outcome was all-cause mortality, determined through linkage with the Canadian Vital Statistics Death Database [32, 37, 41]. Survival time was calculated from the date of the CCHS-MH interview until death or administrative censoring on December 31, 2017. Cardiovascular, cancer, and external-cause mortality were explored using the underlying cause of death recorded in the CVSD. Cause-specific estimates could not be reported because the corresponding unweighted event counts did not satisfy Statistics Canada confidentiality requirements [55].

## Covariates

Age and sex were selected a priori as the primary adjustment variables because both are strongly associated with cannabis use disorder and mortality [8, 26, 27, 56–58]. Age was categorized as 15–24, 25–34, 35–44, 45–54, 55–64, and ≥ 65 years. Sex was classified according to the categories available in the 2012 CCHS-MH. Additional sociodemographic, physical health, and psychiatric variables available in the linked dataset included province, educational attainment, household income, marital status, smoking status, cardiovascular disease, cancer, alcohol use disorder, major depressive disorder, bipolar disorder, panic disorder, social phobia, and generalized anxiety disorder [5, 10, 12, 16, 18, 59]. These variables were not included in the primary survival model because the relatively small number of deaths among respondents with CUD limited model complexity. In addition, several variables, including psychiatric illness, cardiovascular disease, and healthcare utilization, may lie on the causal pathway between CUD and mortality rather than function solely as confounders [10].

# Statistical Analysis

Baseline characteristics were summarized according to lifetime CUD status. All analyses incorporated person-level survey weights supplied by Statistics Canada to account for the complex sampling design [38, 40–42]. Variance estimates were calculated using 1,000 bootstrap replicate weights, as recommended by Statistics Canada [42]. Survey-weighted Kaplan–Meier curves were generated to describe unadjusted survival according to lifetime CUD status. Cox proportional hazards regression was used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between lifetime CUD and all-cause mortality. Three models were estimated: an unadjusted model, a model adjusted for age, and the primary model adjusted for age and sex. The proportional hazards assumption was assessed by visual inspection of log-minus-log survival plots. As a secondary analysis, survey-weighted logistic regression adjusted for age and sex was used to estimate average marginal predicted

probabilities of death. Marginal predictions were obtained by assigning each respondent sequentially to the CUD and non-CUD groups while retaining the observed covariate distribution, and averaging predictions across the analytic sample. Analyses were conducted within the secure Statistics Canada Research Data Centre environment using Stata/SE version 18.0 [60].

# Ethics Approval

This study was approved by the University of Calgary Conjoint Health Research Ethics Board (REB23-1226) and was conducted in accordance with the Declaration of Helsinki and the Canadian Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. Participants in the Canadian Community Health Survey–Mental Health provided informed consent to participate and, where applicable, consented to record linkage. No additional consent was required for this secondary analysis of de-identified data. The analysis was conducted within the Prairie Regional Research Data Centre under Microdata Research Contract No. 11070.

## RESULTS

# Sample Characteristics

The analytic sample included 20,805 respondents and represented approximately 28.2 million Canadians after application of the survey weights. The weighted prevalence of lifetime CUD was 6.5%. Respondents with lifetime CUD were younger than those without CUD, with mean ages of 37.1 years (95% CI 36.1–38.2) and 46.3 years (95% CI 46.1–46.5), respectively. Respondents with lifetime CUD were also more likely to be male (Table 1). During follow-up, the weighted proportion who died was 1.6% (95% CI 0.9–2.8) among respondents with lifetime CUD and 3.7% (95% CI 3.4–4.0) among respondents without lifetime CUD.

# All-cause Mortality

Mean follow-up was 5.5 years. The unadjusted Kaplan–Meier estimates reflected the lower crude mortality observed among respondents with lifetime CUD (Fig. 1). In the unadjusted Cox model, lifetime CUD was associated with an HR for all-cause mortality of 0.63 (95% CI 0.35–1.15). After adjustment for age, the direction of the estimate reversed (HR 1.58, 95% CI 0.87–2.85), indicating that the crude comparison was strongly confounded by the younger age distribution of respondents with CUD. In the primary age- and sex-adjusted model, lifetime CUD was associated with an HR of 1.32 (95% CI 0.71–2.43; p = 0.377) (Table 2). Mortality was higher among males than females (HR 1.63, 95% CI 1.36–1.95). Mortality increased markedly across the older age groups. The secondary logistic regression analysis produced a similar estimate for lifetime CUD (adjusted OR 1.36, 95% CI 0.71–2.62; p = 0.355) (Table 3).

# Marginal Predicted Probabilities

The age- and sex-adjusted predicted probability of death during follow-up was 3.52% (95% CI 3.23–3.81) among respondents without lifetime CUD and 4.59% (95% CI 2.13–7.06) among respondents with

lifetime CUD (Table 4). The model-based difference was not statistically distinguishable from zero (p = 0.358).

## Cause-Specific Mortality

Cause-specific analyses were conducted for cardiovascular, cancer, and external-cause mortality. The estimates could not be released because the underlying event counts did not meet Statistics Canada disclosure requirements.

# DISCUSSION

## Principal Findings

In this nationally representative Canadian household cohort, lifetime CUD was associated with an age- and sex-adjusted HR for all-cause mortality of 1.32, although the confidence interval was wide and included the null. The data were therefore compatible with no association, but they did not exclude a potentially meaningful elevation in mortality. The crude results initially suggested lower mortality among respondents with CUD. This difference was attributable principally to age: respondents with lifetime CUD were approximately nine years younger on average than respondents without CUD. Once age was included in the model, the estimate changed from below to above the null. The reversal demonstrates why unadjusted mortality proportions are misleading when exposure groups have markedly different age distributions. This study adds a population-based perspective to evidence that has largely arisen from clinical and administrative cohorts. The structured survey assessment identified individuals irrespective of whether their CUD had been recognized or documented in healthcare. Consequently, the exposed group included people across a broader range of severity, recency, remission status, and healthcare engagement than cohorts defined through emergency department visits, hospitalizations, or recorded clinical diagnoses.

## Comparison with Previous Research

The direction of the adjusted association in this study is broadly consistent with literature suggesting elevated mortality among people with CUD, but its magnitude was substantially smaller than estimates from treatment- and hospital-identified cohorts. In Denmark, people entering treatment for cannabis-related problems experienced mortality approximately five times higher than expected, and excess mortality remained evident after excluding participants with opioid or stimulant use or a history of injection drug use [16]. In Italy, mortality was elevated among people treated for CUD alone and was substantially greater among those with co-occurring alcohol use disorder [17]. In Ontario, people receiving incident emergency department or hospital care for CUD had an adjusted 2.79-fold higher five-year mortality risk than matched members of the general population [8]. The Ontario cohort also demonstrated especially elevated mortality from suicide, trauma, opioid and other drug poisoning, and lung cancer [8].

The pronounced age confounding observed in this study is consistent with previous Canadian survey-linkage analyses in which crude associations between psychiatric exposures and mortality differed substantially from demographically adjusted estimates [31, 34].

These estimates should not be treated as directly interchangeable with the present result. Treatment and hospital-based studies condition inclusion on healthcare contact for a cannabis-related disorder or complication. They therefore select a population enriched for active and severe disorder, psychiatric destabilization, polysubstance use, acute injury, social adversity, and other factors associated with premature mortality. The present study instead identified lifetime DSM-IV cannabis abuse or dependence through a structured population interview, regardless of whether the disorder had been recognized clinically. Its exposed group consequently included people with remote, remitted, untreated, and potentially less severe disorder. The smaller point estimate in the present study is therefore compatible with a severity gradient in which mortality risk is concentrated among people with persistent or clinically consequential CUD rather than distributed uniformly across everyone with a lifetime history.

Studies examining cannabis exposure rather than CUD provide additional context but have produced less consistent findings. Earlier population cohorts found that crude mortality associations were substantially attenuated after adjustment for social and behavioural factors [7, 8]. The UK Biobank study identified increased cardiovascular mortality among women with heavy lifetime cannabis exposure but did not demonstrate statistically distinguishable increases in all-cause mortality in either sex [9]. A recent meta-analysis reported an elevated pooled risk of all-cause mortality among people who used cannabis, but the estimate was characterized by extreme heterogeneity, reliance on observational and frequently unadjusted estimates, and low certainty of evidence [10]. Differences in exposure—ever use, cumulative use, heavy use, current use, administrative diagnosis, treatment entry, and DSM-defined lifetime disorder—likely account for part of the inconsistency across studies.

The present study adds to this literature in three ways. First, it examined diagnostically defined lifetime CUD rather than cannabis consumption alone. Second, it identified cases independently of healthcare contact, extending mortality research beyond the treatment and hospital populations that dominate the existing literature. Third, it used a nationally representative Canadian household cohort with objective linkage to vital statistics. The study therefore provides an estimate of average mortality across the broader community spectrum of lifetime CUD rather than an estimate restricted to people whose disorder generated clinical recognition or acute care.

# Exposure Measurement and Interpretation

The contrast between the present estimate and stronger associations reported in administrative cohorts also illustrates the importance of case ascertainment. The exposure in this study was a combined lifetime DSM-IV cannabis abuse-or-dependence measure obtained through a structured diagnostic interview. It did not establish whether the disorder was active at baseline, when it began, how long it persisted, whether it had remitted, or how severe it had been. Respondents with remote or lower-severity disorder were therefore grouped with respondents who may have had active and persistent CUD.

Administrative data have the opposite measurement profile. They identify disorder only when CUD is clinically recognized, documented, and coded during healthcare contact. Our systematic review found substantial variation in the diagnostic codes, encounter thresholds, healthcare settings, and observation periods used to define CUD in administrative research, with no included study reporting empirical validation of the applied case definition [21]. A diagnostic code is therefore not equivalent to a standardized psychiatric assessment, and differences across administrative studies may reflect both underlying clinical risk and variation in case-definition performance.

These two forms of ascertainment should be understood as complementary. Survey interviews identify symptom-defined disorder independently of treatment engagement but may be affected by recall, nonresponse, diagnostic architecture, and limited temporal specificity. Administrative data capture clinically recognized cases longitudinally but are affected by underdiagnosis, coding variation, healthcare access, and selection toward more severe presentations. Prior work on Canadian cannabis surveillance and administrative case ascertainment has emphasized that cannabis exposure, symptom-defined disorder, clinically recognized disorder, healthcare contact, and cannabis-attributable harm are related but non-equivalent constructs [25, 52].

Record linkage substantially strengthened ascertainment of death in the present study, but it could not remedy limitations in the baseline CUD measure. More complete outcome measurement does not create more specific exposure classification. If excess mortality is concentrated among people with current, persistent, or severe CUD, averaging across a heterogeneous lifetime exposure group would be expected to attenuate the observed association. The direction and magnitude of that attenuation cannot be determined from these data, but it provides a plausible explanation for why the present estimate was smaller and less precise than estimates from hospital-identified cohorts.

# Public Health Implications

The findings should not be interpreted as indicating that CUD is harmless or that mortality risk is absent. Rather, they show that mortality associated with a broad lifetime community definition was estimated imprecisely over a relatively short follow-up period. The confidence interval included both no association and an elevation in risk that could be clinically meaningful. Other established consequences of CUD—including psychiatric morbidity, injury, functional impairment, cardiovascular disease, and healthcare utilization—remain relevant regardless of whether a statistically distinguishable mortality association was observed in this cohort. In an Alberta population-based administrative cohort, clinically documented CUD was associated with a 57% higher risk of incident adverse cardiovascular events [18], providing one plausible pathway through which persistent disorder could influence longer-term mortality.

The results caution against extrapolating mortality estimates from hospital-identified CUD to everyone with a lifetime history of disorder. Conversely, the more modest estimate observed in this community cohort should not be generalized to people with active, persistent, severe, or acutely destabilizing CUD. Surveillance systems should distinguish cannabis exposure, lifetime disorder, current disorder, severity, treatment engagement, and acute cannabis-attributable harms. Prior Canadian work has shown that

national surveillance remains oriented primarily toward cannabis exposure rather than clinically defined disorder, while administrative definitions of CUD are heterogeneous and largely unvalidated [25, 52].

Future research should integrate rather than privilege individual data sources. Repeated DSM-5-aligned survey assessments could characterize incidence, persistence, remission, and severity. Validated administrative case definitions could identify clinically recognized disorder with known sensitivity and specificity. Linkage to health services and vital statistics could then estimate morbidity and mortality across different levels of severity and healthcare engagement. Canada has the infrastructure required for this work, but stronger harmonization across surveys, clinical data, administrative records, and mortality registries is needed. Survey and administrative systems capture different manifestations of CUD and should be interpreted as complementary rather than interchangeable [25, 26].

# Strengths and Limitations

This study has several strengths. It used a large, nationally representative household survey with a standardized diagnostic interview and objective mortality ascertainment through linkage to national vital statistics. Survey and bootstrap weights were used to account for the complex sampling design. The analysis also demonstrated the substantial confounding produced by age and presented both relative estimates and adjusted absolute probabilities.

Several limitations should be considered. First, few deaths occurred among respondents with lifetime CUD. This produced wide confidence intervals, constrained covariate adjustment, and prevented release of cause-specific results. The principal limitation was the small number of mortality events rather than incomplete ascertainment of death. Second, follow-up of approximately 5.5 years was relatively short for examining mortality in a household cohort whose members with CUD were comparatively young. Longer follow-up may be required to detect mortality arising through chronic cardiovascular, respiratory, oncologic, or other disease pathways. Third, the exposure was restricted to the combined lifetime DSM-IV cannabis abuse-or-dependence variable available in the linked file. Current disorder, recency, duration, remission, and separate severity categories were unavailable. The study could not determine whether mortality differed between cannabis abuse and dependence or between active and remitted disorder. Fourth, residual confounding remains possible. The limited number of events prevented stable adjustment for a larger set of psychiatric, substance use, physical health, and social variables. Some of these factors may be confounders, while others may be consequences or intermediates associated with CUD. Fifth, the CCHS-MH excluded institutionalized populations, people living on reserves and other Indigenous settlements, full-time members of the Canadian Armed Forces, and residents of some remote regions. Survey nonresponse may also have disproportionately excluded people with severe substance use or social instability. The findings may consequently underrepresent groups at greatest risk of cannabis-related harms and premature mortality. Finally, the observational design does not establish that CUD caused the deaths observed. The estimate reflects the association between a lifetime history of DSM-IV cannabis abuse or dependence and subsequent all-cause mortality under the measurement and follow-up conditions available in this linked cohort.

# Conclusions

In this nationally representative Canadian household cohort, lifetime DSM-IV cannabis abuse or dependence was associated with an age- and sex-adjusted HR for all-cause mortality of 1.32, but the estimate was imprecise and not statistically distinguishable from the null. The findings neither establish increased mortality nor exclude a potentially meaningful association. The smaller estimate relative to healthcare-identified cohorts is plausibly explained by differences in the populations and forms of disorder captured, including severity, recency, remission, and healthcare engagement. Longer follow-up, larger linked cohorts, and more temporally specific measures of CUD are needed to estimate mortality risk more precisely and identify the subgroups in whom excess mortality is concentrated.

# Declarations

**Ethics Approval and Consent to Participate**: This study was approved by the University of Calgary Conjoint Health Research Ethics Board on January 24, 2024 (REB23-1226) and was conducted in accordance with the principles of the Declaration of Helsinki and the Canadian Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans. The analysis was conducted within the Prairie Regional Research Data Centre under Microdata Research Contract No. 11070. Participants in the Canadian Community Health Survey–Mental Health provided informed consent to participate in the survey and, where applicable, consented to record linkage. No additional participant contact or consent was required for this secondary analysis of de-identified data. Access to and analysis of the data were governed by the Statistics Act and Statistics Canada confidentiality requirements.

**Consent for Publication:** Not applicable. The manuscript contains no identifiable individual-level information.

**Availability of Data and Materials**: The Canadian Community Health Survey–Mental Health and Canadian Vital Statistics Death Database master files used in this study are held by Statistics Canada and may be accessed by approved researchers through the Research Data Centre Program. The data cannot be shared publicly because of statutory confidentiality restrictions. Analytic code may be made available subject to Statistics Canada disclosure requirements and Research Data Centre approval.

**Competing Interests**: A.B. serves as Co-Chair of the Canadian Psychiatric Association Section on Addiction Psychiatry and as Deputy Editor of the Canadian Journal of Addiction. These unpaid roles had no involvement in the conduct or reporting of this study. G.M. and S.B.P. declare that they have no competing interests.

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# Tables

**Table 1.** Survey-weighted characteristics of respondents by lifetime cannabis use disorder status, 2012 Canadian Community Health Survey–Mental Health linked mortality cohort

**A. Mortality Status by Lifetime CUD**

| Outcome Status | No Lifetime CUD % (95% CI) | Lifetime CUD % (95% CI) | p-value |
|---|---|---|---|
| Alive at end of follow-up | 96.3 (96.0–96.6) | 98.4 (97.2–99.1) | <0.001 |
| Died during follow-up | 3.7 (3.4–4.0) | 1.6 (0.9–2.8) | |

**B. Sex Distribution**

| Sex | No Lifetime CUD % | Lifetime CUD % | p-value |
|---|---|---|---|
| Female | 52.7 | 28.6 | <0.001 |
| Male | 47.3 | 71.4 | -- |

**C. Age at Baseline**

| Measure | No Lifetime CUD | Lifetime CUD | p-value |
|---|---|---|---|
| Mean age, years (95% CI) | 46.3 (46.1–46.5) | 37.1 (36.1–38.2) | <0.001 |

**Note.** Estimates are survey-weighted using Statistics Canada person-level weights. Confidence intervals (CIs) were estimated using bootstrap replicate weights to account for the complex survey design. Lifetime cannabis use disorder (CUD) was defined using DSM-IV cannabis abuse or dependence criteria derived from the World Health Organization Composite International Diagnostic Interview (WHO-CIDI) administered in the 2012 Canadian Community Health Survey–Mental Health (CCHS-MH). Mortality status was determined through linkage to the Canadian Vital Statistics Death Database. Follow-up extended from the survey interview date until death or administrative censoring on December 31, 2017. P-values represent unadjusted between-group comparisons. CUD = cannabis use disorder; CI = confidence interval; WHO-CIDI = World Health Organization Composite International Diagnostic Interview.

**Table 2.** Survey-weighted Cox proportional hazards model of all-cause mortality, 2012 Canadian Community Health Survey–Mental Health linked mortality cohort

| Predictor | Adjusted Hazard Ratio (95% CI) | p-value |
|---|---|---|
| **Lifetime Cannabis Use Disorder** | | |
| No CUD (reference) | 1.00 | — |
| Lifetime CUD | 1.32 (0.71–2.43) | 0.377 |
| **Sex** | | |
| Female (reference) | 1.00 | — |
| Male | 1.63 (1.36–1.95) | <0.001 |
| **Age Group (years)** | | |
| 15–24 (reference) | 1.00 | — |
| 25–34 | 0.77 (0.13–4.65) | 0.771 |
| 35–44 | 4.07 (0.80–20.76) | 0.091 |
| 45–54 | 8.17 (1.79–37.24) | 0.007 |
| 55–64 | 25.57 (5.93–110.17) | <0.001 |
| ≥65 | 120.63 (28.11–517.66) | <0.001 |

**Note.** Hazard ratios were estimated using a survey-weighted Cox proportional hazards model incorporating Statistics Canada person-level weights and 1,000 bootstrap replicate weights. Survival time was measured from the survey interview date until death or administrative censoring on December 31, 2017. Lifetime CUD, sex, and age group were entered simultaneously. CUD = cannabis use disorder; HR = hazard ratio; CI = confidence interval; CCHS-MH = Canadian Community Health Survey–Mental Health.

**Table 3.** Survey-weighted logistic regression model of all-cause mortality, 2012 Canadian Community Health Survey–Mental Health linked mortality cohort

| Predictor | Adjusted Odds Ratio (95% CI) | p-value |
|---|---|---|
| **Lifetime CUD** | | |
| **No CUD (reference)** | 1.00 | — |
| **Lifetime CUD** | 1.36 (0.71–2.62) | **0.355** |
| **Sex** | | |
| **Female (reference)** | 1.00 | — |
| **Male** | 1.68 (1.39–2.04) | **<0.001** |
| **Age Group (years)** | | |
| **15–24 (reference)*** | 1.00 | — |
| **25–34** | 0.76 (0.13–4.65) | **0.771** |
| **35–44** | 4.08 (0.80–20.88) | **0.091** |
| **45–54** | 8.22 (1.80–37.53) | **0.007** |
| **55–64** | 26.09 (6.05–112.57) | **<0.001** |
| **≥65** | **132.96 (30.93–571.51)** | **<0.001** |

**Note.** Odds ratios were estimated using survey-weighted logistic regression incorporating Statistics Canada person-level weights and 1,000 bootstrap replicate weights. The outcome was death from any cause during follow-up. Lifetime CUD, sex, and age group were entered simultaneously. The model is presented as a secondary analysis for comparison with the Cox proportional hazards model in Table 2. CUD = cannabis use disorder; OR = odds ratio; CI = confidence interval; CCHS-MH = Canadian Community Health Survey–Mental Health.

**Table 4.** Age- and sex-adjusted predicted probabilities of all-cause mortality by lifetime cannabis use disorder status

| Lifetime CUD Status | Adjusted Predicted Probability of Death, % (95% CI) | p-value |
|---|---|---|
| No CUD | 3.5 (3.2–3.8) | — |
| Lifetime CUD | 4.6 (2.1–7.1) | 0.358 |

**Note.** Average marginal predicted probabilities, expressed as percentages, were derived from the survey-weighted logistic regression model in **Table 3**. Predictions were standardized to the observed distribution of age and sex in the analytic population. Confidence intervals were estimated using 1,000

bootstrap replicate weights. The p-value represents the model-based contrast between respondents with and without lifetime CUD. CUD = cannabis use disorder; CI = confidence interval.

# Figures

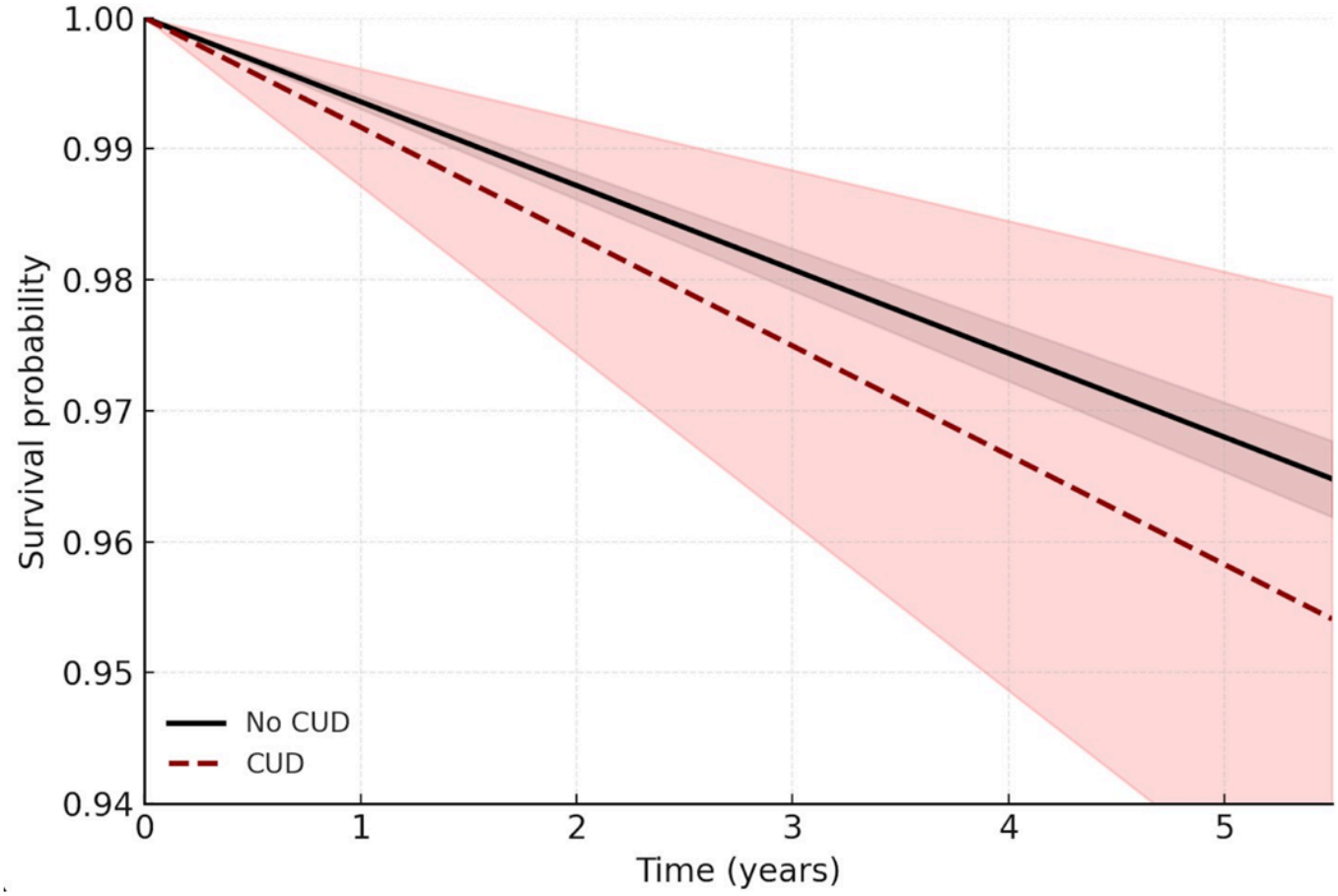


**Figure 1**

Survey-weighted Kaplan–Meier estimates of all-cause survival by lifetime cannabis use disorder status, 2012 Canadian Community Health Survey–Mental Health linked mortality cohort

**Note.** Survey-weighted Kaplan–Meier estimates of all-cause survival among respondents with and without lifetime cannabis use disorder (CUD) in the 2012 Canadian Community Health Survey–Mental Health linked to the Canadian Vital Statistics Death Database. Lifetime CUD was defined as DSM-IV cannabis abuse or dependence derived from the World Mental Health Composite International Diagnostic Interview. Time was measured from the survey interview date until death or administrative censoring on December 31, 2017. Shaded areas represent 95% confidence intervals. Curves are unadjusted; adjusted hazard ratios are reported in **Table 2**.