Monitoring Health Concerns Related to Marijuana in Colorado: 2015 Update

Colorado Hospital Association Data, 2000-June 2015

Retail Marijuana Public Health Advisory Committee

Updated January 25, 2016

COLORADO
Department of Public Health & Environment

Primary Authors:

Katelyn Hall, MPH, Statistical Analyst, Retail Marijuana Health Monitoring, Colorado Department of Public Health and Environment.

Lisa Barker, MPH, Program Manager, Retail Marijuana Health Monitoring, Colorado Department of Public Health and Environment.

Mike Van Dyke, PhD, CIH, Chief, Environmental Epidemiology, Occupational Health and Toxicology Branch, Colorado Department of Public Health and Environment.

Devon Williford, MPH, Health GIS Specialist, Center for Health and Environmental Data, Colorado Department of Public Health and Environment.

Contributing Authors:

Daniel I. Vigil, MD, MPH, Program Manager, Retail Marijuana Health Monitoring, Colorado Department of Public Health and Environment.

Primary Reviewers:

Shireen Banerji, PharmD, DABAT, Managing Clinical Toxicologist Rocky Mountain Poison & Drug Center (RMPDC).

Judith Shlay, MD MSPH, Associate Director of Denver Public Health, Professor of Family Medicine, University of Colorado School of Medicine.

Technical Advisor:

Kirk Bol, MSPH, Vital Statistics Program Manager, Center for Health and Environmental Data, Colorado Department of Public Health and Environment.

Introduction

The Colorado Hospital Association (CHA) collects data on hospitalizations (HD) and emergency department (ED) discharges from participating hospitals in the state of Colorado. The data include patient demographics, admit and discharge dates, and up to 30 ICD-9-CM discharge diagnoses/billing codes and procedure codes. There are over 100 members of CHA which includes the vast majority of hospitals in Colorado. However, the database does not include inpatient mental health facilities, ambulatory surgical centers, long term care facilities, military hospitals, and other outpatient treatment settings. ED visits that result in a hospitalization are counted as an HD making each HD and ED visit mutually exclusive events. HD and ED visits for non-Colorado residents are included in this database. The CHA HD data are available from year 2000 through June of 2015 and the ED visits data from 2011 through June of 2015. The full year of 2015 data will not be available until spring 2016. The CHA dataset was used to investigate rates of HD and ED visits associated with possible marijuana exposures, diagnoses, and billing codes.

Methods

Marijuana Exposures, Diagnoses, and/or Billing Codes

To determine HD and ED visits that were possibly associated with marijuana four ICD-9-CM diagnosis codes were used. The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) is a U.S. Centers for Disease Control and Prevention modification of a set of codes established by the World Health Organization.[1,2] These codes are used to assign alphanumeric codes to patient diagnoses. The four codes used in these analyses were:

- E854.1 - Accidental poisoning by psychodysleptics (hallucinogens)[3]
- 969.6 - Poisoning by psychodysleptics (hallucinogens)[4]
- 305.20-305.23 - Nondependent cannabis abuse unspecified, continuous, episodic, and in remission[5]
- 304.30-304.33 - Cannabis dependence unspecified, continuous, episodic, and in remission[6]

For codes E854.1 and 969.6, psychodysleptics includes cannabis derivatives, lysergide (LSD), marijuana (derivatives), mescaline, psilocin, and psilocybin.[3,4] The prevalence of use of other drugs in this category is low. HD and ED visits with possible marijuana exposure, diagnoses, or billing codes were determined by the presence of any of the four discharge codes. When examining HD and ED visits with marijuana exposures only ICD-9-CM codes E854.1 and 969.6 were used. Each HD or ED visit with marijuana-associated codes was counted once regardless of the number of marijuana-associated codes listed. More details are provided in Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results.

We examined HD and ED visit data in four different ways:

1. Possible marijuana exposures in children under 9 years of age: These data were chosen to represent unintentional use of marijuana by children and consisted of HD or ED visits that were coded with discharge codes related to poisoning by psychodysleptics.[7,8] Though

psychodysleptic drugs include more than just marijuana, other drugs in this class have a low prevalence of use. In addition, the age cut-off of 9 years was chosen to represent children who were unlikely to be intentionally using marijuana. However, these data are not specific for marijuana use or unintentional use. This is a significant limitation.

2. Possible marijuana exposures in patients 9 years and older: These data were chosen to represent intentional and unintentional overuse of marijuana by adolescents and adults and consisted of HD or ED visits that were coded with discharge codes related to poisoning by psychodysleptics.[7,8] Similar limitations apply to these data as described above.

3. Possible Marijuana Exposures, Diagnoses, or Billing Codes in the First Three Diagnosis Codes: These data were chosen to restrict marijuana-associated codes to being closer to the primary diagnosis code thus possibly indicating marijuana use was a contributing factor to the underlying reason for the HD or ED visit. These data consisted of HD and ED visits coded with discharge codes related to poisoning by psychodysleptics or separate codes related to cannabis abuse in the first three diagnosis codes which are more likely to be clinically significant codes. However, without a full medical record review, we cannot determine with certainty whether marijuana was truly a casual or contributing factor. This is a significant limitation.

4. Possible Marijuana Exposures, Diagnoses, or Billing Codes in Any of Listed Diagnosis Codes: These data were chosen to represent the HD and ED visits where marijuana could be a causal, contributing, or coexisting factor noted by the physician during the HD or ED visit. For these data, marijuana use is not necessarily related to the underlying reason for the HD or ED visit, but may indicate marijuana use. Sometimes these data are referred to as HD or ED visits "with any mention of marijuana". HD and ED visits in this group of data had been coded with the same codes as described in number three above, but the codes could be in any of the up to 30 diagnosis codes provided.

Primary Diagnosis

Primary diagnoses were examined and compared for HD and ED visits with and without marijuana exposures, diagnoses, or billing codes for all Colorado HD and ED visits from 2000 through June 2015 (2011 through June 2015 for ED visits). The Healthcare Cost and Utilization Project's (HCUP) Multiple Level Clinical Classification Software (CCS) was used to categorize primary diagnoses into 18 broad categories. Details of these categories can be found in the Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results.[9]

Marijuana Legalization Eras

Rates of HD and ED visits were described over time by year. To evaluate the impact of changes in marijuana laws in Colorado, four marijuana legalization eras were chosen to display these findings.

- 2000 – Prior to Legalized Medical Marijuana
- 2001-2009 – Medical Marijuana Legalized[10]

- 2010-2013 – Medical Marijuana Commercialized[11]
- 2014-2015 – Retail (Recreational) Marijuana Legalized[12]

Demographics

HD and ED visits were stratified by gender, age, race/ethnicity, and county. More details on the demographics can be found in Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results.

Statistical Analysis

The SAS version 9.3 (SAS Institute Inc.) statistical software package was used for all statistical analyses. Details on the analysis populations can be found in Appendix Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results. Rates of HD and ED visits were calculated with the number of HD or ED visits with marijuana-associated discharge codes for a time period in the numerator and total number of HD or ED visits during that time period in the denominator. This proportion was multiplied by 100,000 (1,000 for county level data) to obtain a rate. Rates of HD and ED visits were compared across years and marijuana legalization eras, and stratified by gender, age, race/ethnicity, and county. In examining rates across years, a percent change was calculated by each year to compare the trends across time. To determine significant differences in rates across marijuana legalization eras, a Pearson X^2 test was performed. A Bonferroni correction was used to adjust for multiple comparisons and the *p*-values required for significance were less than or equal to 0.001.

Prevalence of primary diagnosis categories were calculated for HD and ED visits with marijuana-associated discharge codes and for HD and ED visits without marijuana-associated discharge codes. Prevalence ratios and 95% confidence intervals were calculated comparing the prevalence of primary diagnosis categories by HD or ED visits with marijuana-associated discharge codes to HD or ED visits without marijuana-associated discharge codes.

Results

The rates of HD and ED visits with possible marijuana exposure have increased over time since medical marijuana legalization in 2001 (Figures 1 & 2). However, this trend was only significant from medical marijuana legalization to medical marijuana commercialization for HD among those under 9 years old (Figures 1), and from medical marijuana commercialization to retail marijuana legalization in HD and ED visits among those 9 years and older (Figure 2). The number of HD and ED visits with possible marijuana exposures among children under 9 years is higher in urban areas compared to rural areas in Colorado (Map1).

The rates of possible marijuana exposure, diagnoses, or billing codes among HD and ED visits with marijuana-associated codes within the first three listed diagnosis codes remained stable from 2000 to 2005, and even declined from 2005 to 2009. However, an upward trend began in 2010 for HD and 2012 for ED visits (Figure 3). When examining the rates of possible marijuana exposures, diagnoses, or billing codes across years with marijuana-associated codes in any listed diagnosis code, there was an increasing trend in HD from 2001 to January through June 2015 and an increasing trend in ED visits from 2012 to 2014. However, in January through

June of 2015 there was a decline in ED visits compared to 2014 (Figure 5). This declining trend was present when examining marijuana-associated codes in any listed diagnosis code (Figure 5) and when examining marijuana-associated codes within the first three listed diagnosis codes (Figure 3). When viewing the annual rates collapsed into marijuana legalization eras, the decrease in ED visits in January through June of 2015 was no longer apparent and a significantly increasing trend was observed for both ED visits with marijuana-associated codes in the first three diagnosis codes and ED visits with any mention of marijuana with the legalization of retail marijuana (Figures 4 & 6). Significanty increasing trends were observed in rates of HD with marijuana-associated codes within the first three diagnosis codes from the commercialization of medical marijuana to retail marijuana legalization and rates of HD with any mention of marijuana showed a significantly increasing trend from the legalization of medical marijuana to the legalization of retail marijuana (Figures 4 & 6). The rates of HD and ED visits with possible marijuana exposure, diagnoses, or billing codes was highest in males, ages 9-24 years, and Black race (Figures 7, 8, & 9). Rates of HD with any mention of marijuana have increased throughout Colorado since 2004 with the highest rates in Crowley county in 2014 (Maps 2, 3, & 4). Rate of ED visits with any mention of marijuana have increased in throughout Colorado from 2011-2013 to 2014 (Maps 5 & 6). In 2014, the highest rates of ED visits with possible marijuana exposure, diagnoses, or billing codes were in Summit county, while the highest numbers of ED visits were in Pueblo county (Map 6).

Examination of the 18 broad primary diagnosis categories for HD and ED visits revealed a higher prevalence of *mental illness* among HD and ED visits with marijuana-associated codes compared to HD and ED visits without marijuana-associated codes (Figures 10 & 12). Also, there was a higher prevalence of *injuries and poisonings*, and *diseases of the nervous system and sense organs* among HD with marijuana-associated codes compared to HD without marijuana-associated codes (Figure 12). The prevalence of *unclassified codes and E codes* was higher among ED visits with marijuana-associated codes. Further investigation into the *mental illness* category revealed increased prevalence of *suicide and intentional self-inflicted injury*, *substance-related disorders*, *schizophrenia and other psychotic disorders, personality disorders*, and *mood disorders* in ED visits with marijuana-associated codes compared to those without (Figure 11) and an increased prevalence of *suicide and intentional self-inflicted injury*, *substance-related disorders*, *schizophrenia and other psychotic disorders*, *mood disorders*, *impulse control disorders not elsewhere classified*, *attention deficit, conduct, and disruptive behavior disorders*, and *anxiety disorders* in HD with marijuana-associated codes compared to those without (Figure 13). Further, investigation into *injury and poisoning* and *diseases of the nervous system and sense organs* among HD revealed increased prevalence in sub-categories of *open wounds*, *intracranial injury*, *crushing injury or internal injury*, *poisoning*, *burns*, *epilepsy and convulsions*, and *coma, stupor, and brain damage* in HD with marijuana-associated codes compared to those without marijuana-associated codes (Figures 14 & 15).

A summary of the results can be found with the following figures and detailed results can be found in the **Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results.**

Limitations

The use of marijuana-related ICD-9-CM codes is not fully standardized and there may be differences in coding from hospital to hospital. This summary does not account for confounders like increases or changes in marijuana related discharge coding by the hospitals. Changes in coding could have occurred due to an overall increased awareness regarding marijuana, changes in physician care or reporting related to marijuana, an increased honesty in patients reporting marijuana use to health care providers, or changes in coding practices by hospitals and emergency departments. Changes in marijuana coding could result in an over or underestimate HD and ED visit rates depending on the marijuana legalization era.

Furthermore, overall rates are not adjusted for gender, race/ethnicity, or age. Stratification of rates by these demographics show they differ across these demographics, meaning some populations may have a higher marijuana use burden than others.

A major limitation is the inability to determine whether a discharge code is an exposure or diagnosis or if it is merely for billing. Furthermore, use of these diagnosis codes does not necessarily indicate marijuana was the primary (or even secondary) reason for the HD or ED visit, rather the presence of a marijuana-associated code reflects that marijuana use was noted by the treating physician. Therefore, this summary quantifies HD and ED visits with marijuana-associated codes and does not quantify HD and ED visits due to marijuana. We hypothesize that this summary reflects marijuana use despite the limitations; however, it does not necessarily show the health care burden of marijuana use. Transition to ICD-10 coding may help clarify this issue.

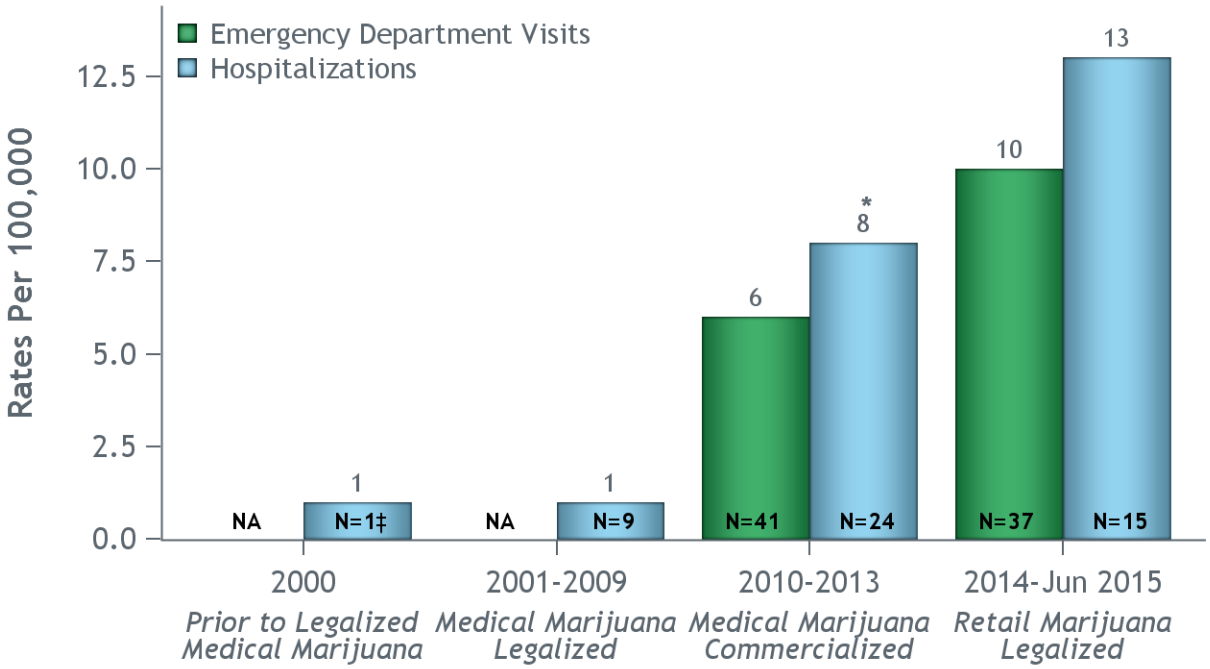
In examining the 18 broad primary diagnosis categories in HD and ED visits with any mention of marijuana, causal associations between marijuana use and the diagnosis categories cannot be made. Furthermore, temporality between the associations found cannot be assessed; meaning it is unclear whether marijuana use preceeded the primary diagnosis or the primary diagnosis preceeded marijuana use. The associations found between HD and ED visits with marijuana coding and primary diagnosis categories point to specific health outcomes to direct future investigation and resources.

Due to inconsistent and partial reporting by hospitals, early years of the HD data may be incomplete as well as 2011 ED visits data. CHA data is prepared and geocoded in six-month intervals. At the time this report was completed, CHA data was available from 2000 to June 2015; however, only data from 2004-2014 was geocoded at the county level. Further limitations of the CHA data include the inability to link patients to multiple visits meaning the data cannot be analyzed at the individual patient level. The data must be interpreted as HD or ED visit events, which does not account for one individual with multiple events.

References

1. Centers for Disease Control and Prevention. Scientific Data Documentation: International Classificaiton of Diseases-9-CM, (1979). 2014; http://wonder.cdc.gov/wonder/sci_data/codes/icd9/type_txt/icd9cm.asp. Accessed November 3, 2015.
2. Practice Management Information Corporation [PMIC]. *International Classification of Diseases 9th Revision Clinical Modification*. Vol 1, 2, & 3. Sixth ed. Los Angeles, California 2015.
3. Practice Management Information Corporation [PMIC]. International Classification of Diseases 9th Revision Clinical Modification. Vol 1, 2, & 3. Sixth ed. Los Angeles, California2015:827.
4. Practice Management Information Corporation [PMIC]. International Classification of Diseases 9th Revision Clinical Modification. Vol 1, 2, & 3 Sixth ed. Los Angeles, California2015:725.
5. Practice Management Information Corporation [PMIC]. International Classification of Diseases 9th Revision Clinical Modification. Vol 1, 2, & 3. Sixth ed. Los Angeles, California2015:314.
6. Practice Management Information Corporation [PMIC]. International Classification of Diseases 9th Revision Clinical Modificaiton. Vol 1, 2, & 3. Sixth ed. Los Angeles, California2015:313-314.
7. Thomas K, Johnson R. *State Injury Indicators Report: Instruction for Preparing 2013 Data*. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control;2015.
8. Safe States. *Consensus Recommendations for National and State Poisoning Surveillance: Report from the Injury Surveillance Work-group (ISW7)*. Atlanta: Safe States; 2012 2012.
9. Healthcare Cost and Utilization Project. Clinical Classification Software (CCS) for ICD-9-CM. https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp. Accessed 07/06/2015.
10. CO Const. amend. 20 art. XVIII §14
11. H.B. 10-1284 (CO 2010).
12. CO Const. amend. 64 art. XVIII §16.

Figure 1. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures† in Children Under 9 Years Old per 100,000 HD and ED Visits in Children Under 9 Years Old by Legalization Eras in Colorado.



*Rate significantly increased from previous time period with a p-value <0.001.
†ICD-9-CM codes 969.6 and E854.1 were used to determine HD and ED visits with possible marijuana exposures.
‡The Ns are the total number of HD or ED visits with possible marijuana exposures in the specified time period.

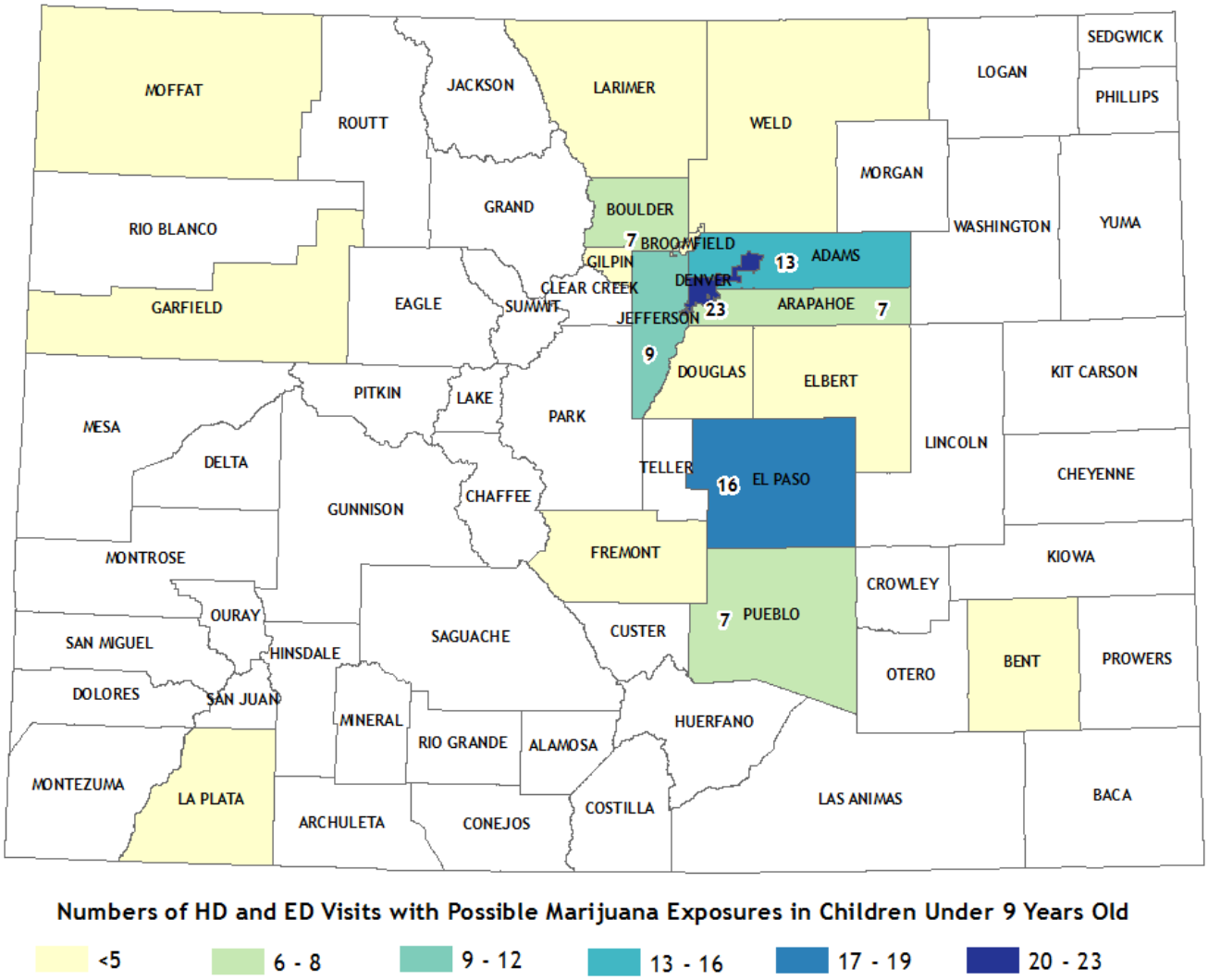
Major Findings

- Among children under 9, rates of HD and ED visits had an increasing trend from 2001-2009 (2011-2013 for ED visits) to 2014 through June 2015.
- Rates of HD with possible marijuana exposures in children under 9 years old significantly increased from 2001-2009 to 2010-2013 by eight fold.
- The highest rates for both HD and ED visits in children under 9 were in 2014 through June 2015 of 13 HD and 10 ED visits per 100,000 HD and ED visits respectively, though these rates were not statistically significantly different from the 2010-2013 (2011-2013 for ED visits) time period.

Data Details

- Data source: Colorado Hospital Association (CHA).
- 2015 data was January 1, 2015 through June 30, 2015.
- NA=Data not available.
- A single individual can be represented more than once in the data; therefore, the rate is HD or ED visits per 100,000 HD or ED visits in children under age 9.

Map 1. Numbers of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures[a] in Children Under 9 Years Old in Colorado from 2004-2014 by County.



[a] ICD-9-CM codes 969.6 and E854.1 were used to determine HD and ED visits with possible marijuana exposures.

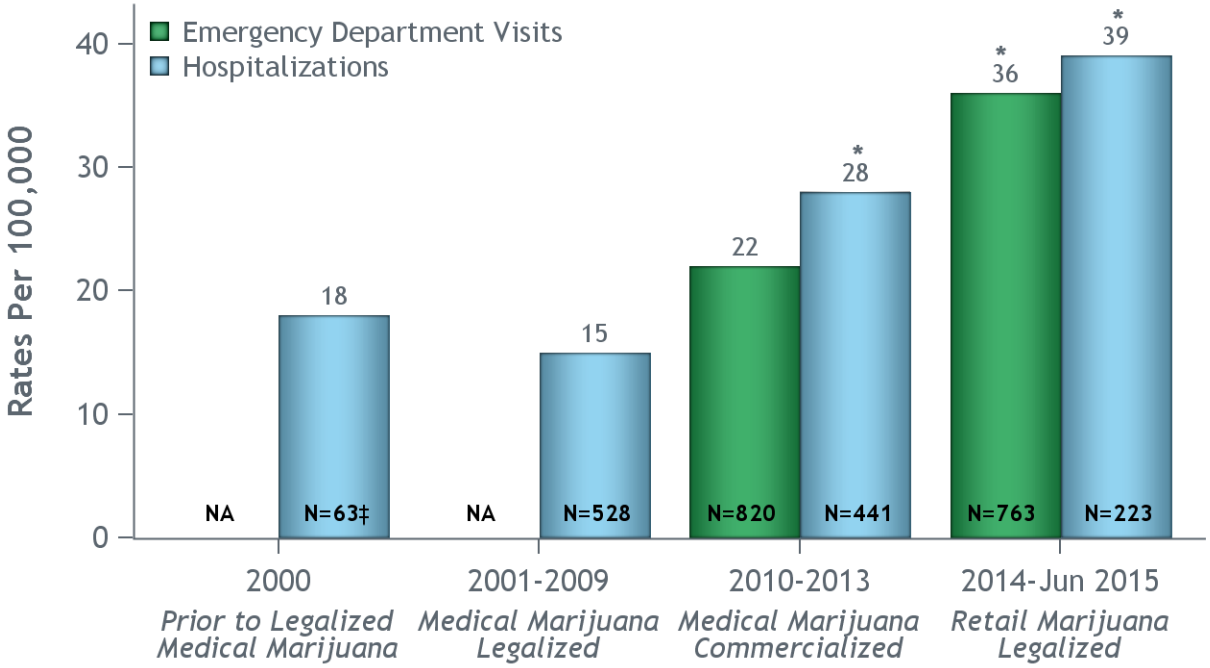
Major Findings

- Numbers of HD and ED visits were highest in Denver (23 HD and ED visits), El Paso (16 HD and ED visits), and Adams (13 HD and ED visits) counties.
- Higher numbers of HD and ED visits were in urban areas compared to rural.

Data Details

Data source: Colorado Hospital Association (CHA). Data geocoded from 2004 forward.
2015 data has not been geocoded and therefore not included in the map. Counties shown in white have no reported HD or ED visits with possible marijuana exposures in children under 9. A single individual can be represented more than once in the data, therefore the count was HD or ED visits.

Figure 2. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures† Patients 9 Years and Older per 100,000 HD and ED Visits in Patients 9 Years and Older by Legalization Eras in Colorado.



*Rate significantly increased from previous time period with a p-value <0.001.
†ICD-9-CM codes 969.6 and E854.1 were used to determine HD and ED visits with possible marijuana exposures.
‡The Ns are the total number of HD or ED visits with possible marijuana exposures in the specified time period.

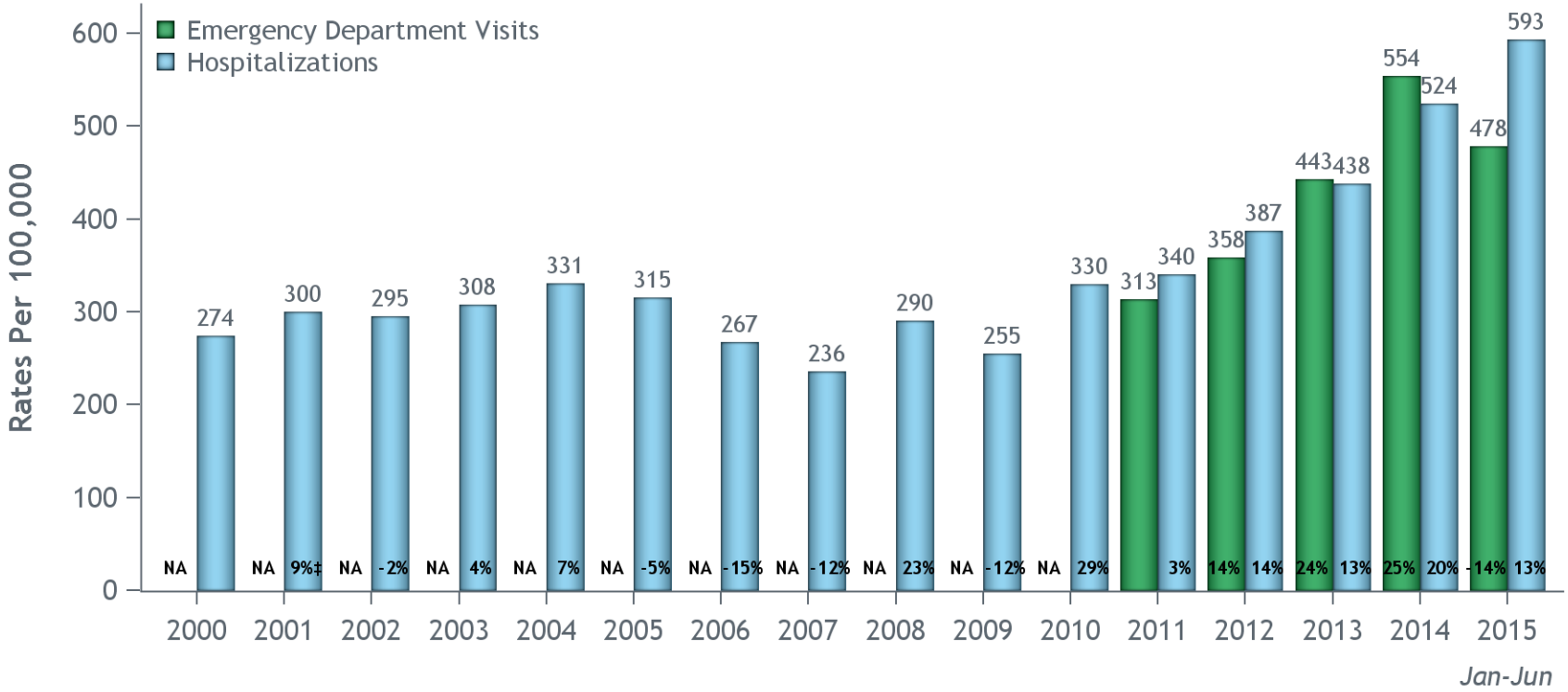
Major Findings

- Rates of HD with possible marijuana exposures in patients 9 years and older significantly increased from 2001-2009 to 2010-2013 by 86.6% and from 2010-2013 to 2014 through June 2015 by 39.3%.
- The highest rates for both HD and ED visits with possible marijuana exposures in patients 9 years and older were in 2014 through June 2015 of 39 HD and 36 ED visits per 100,000 HD and ED visits respectively.
- The rate of ED visits with possible marijuana exposures significantly increased from 2011-2013 to 2014 through June 2015 by 63.6%.

Data Details

- Data source: Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015.
- NA=Data not available.
- A single individual can be represented more than once in the data; therefore, the rate was HD or ED visits per 100,000 HD or ED visits in patients 9 years and older.

Figure 3. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes† in First Three Diagnosis Codes per 100,000 HD and ED Visits by Year in Colorado.



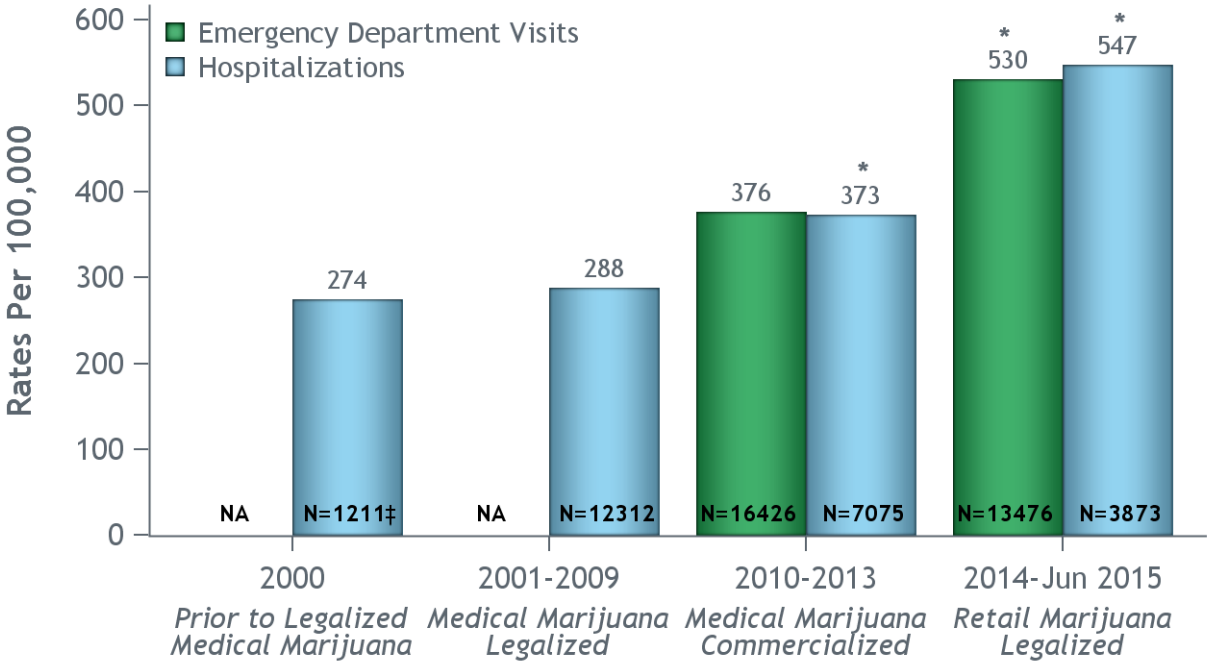
†ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD and ED visits with possible marijuana exposure, diagnoses, or billing codes.
‡The percent change in rates of HD and ED visits compared to the previous year.

Major Findings

- Rates of HD with possible marijuana exposures, diagnoses, or billing codes in the first three diagnosis codes showed an increasing trend from 2010 to January through June of 2015.
- Rates of ED visits with possible marijuana exposures, diagnoses, or billing codes in the first three diagnosis codes showed an increasing trend from 2012 to 2014, but then decreased from 2014 to January through June 2015 by 14%.
- The highest increase in rates of HD was from 2009 to 2010 with an increase of 29% and of 25% from 2013 to 2014 for ED visits.
- The highest rates of HD were in January through June 2015 of 593 per 100,000 and in 2014 for ED visits of 554 per 100,000.

Data Details: Colorado Hospital Association Data, 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available.
A single individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

Figure 4. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes† in First Three Codes per 100,000 HD and ED Visits by Legalization Eras in Colorado.



*Rate significantly increased from previous time period with a p-value <0.001.
†ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD and ED visits with possible marijuana exposure, diagnoses, or billing codes.
‡The Ns are the total number of HD or ED visits with possible marijuana exposures, diagnoses, or billing codes in the specified time period.

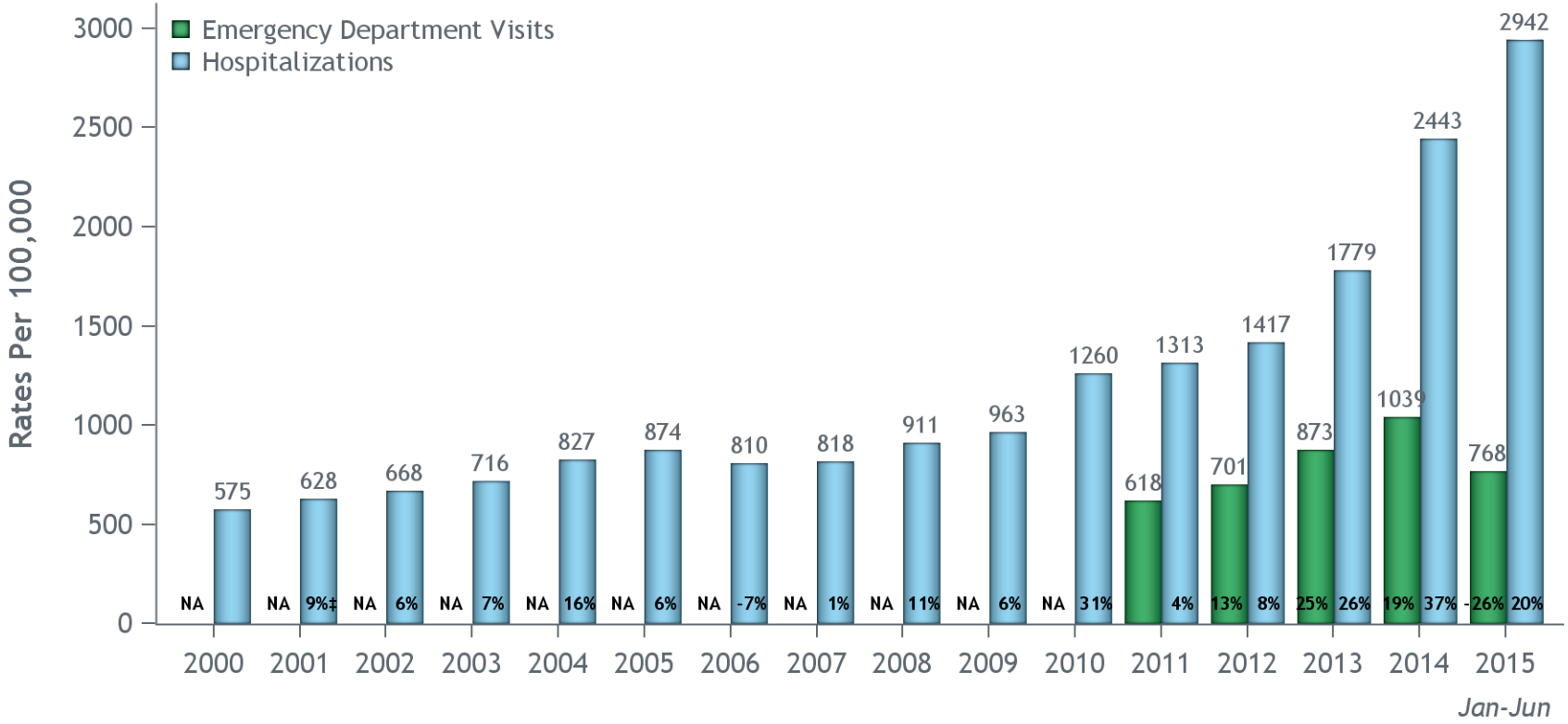
Major Findings

- Rates of HD with possible marijuana exposures, diagnoses, or billing codes in the first three diagnosis codes significantly increase by 29.5% from 2001-2009 to 2010-2013 and by 46.6% from 2010-2013 to 2014 through June 2015.
- Rates of ED visits with possible marijuana exposures, diagnoses, or billing codes in the first three diagnosis codes significantly increase by 40.9% from 2011-2013 to 2014 through June 2015.
- The highest rates of HD and ED visits were in 2014 through June 2015 of 547 per 100,000 and 530 per 100,000 respectively.

Data Details

- Data source: Colorado Hospital Association (CHA), 2015 data was January 1, 2014 through June 30, 2014.
- NA=Data not available.
- An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

Figure 5. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes† per 100,000 HD and ED Visits by Year in Colorado.



†ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD and ED visits with possible marijuana exposure, diagnoses, or billing codes.
‡The percent change in rates of HD and ED visits compared to the previous year.

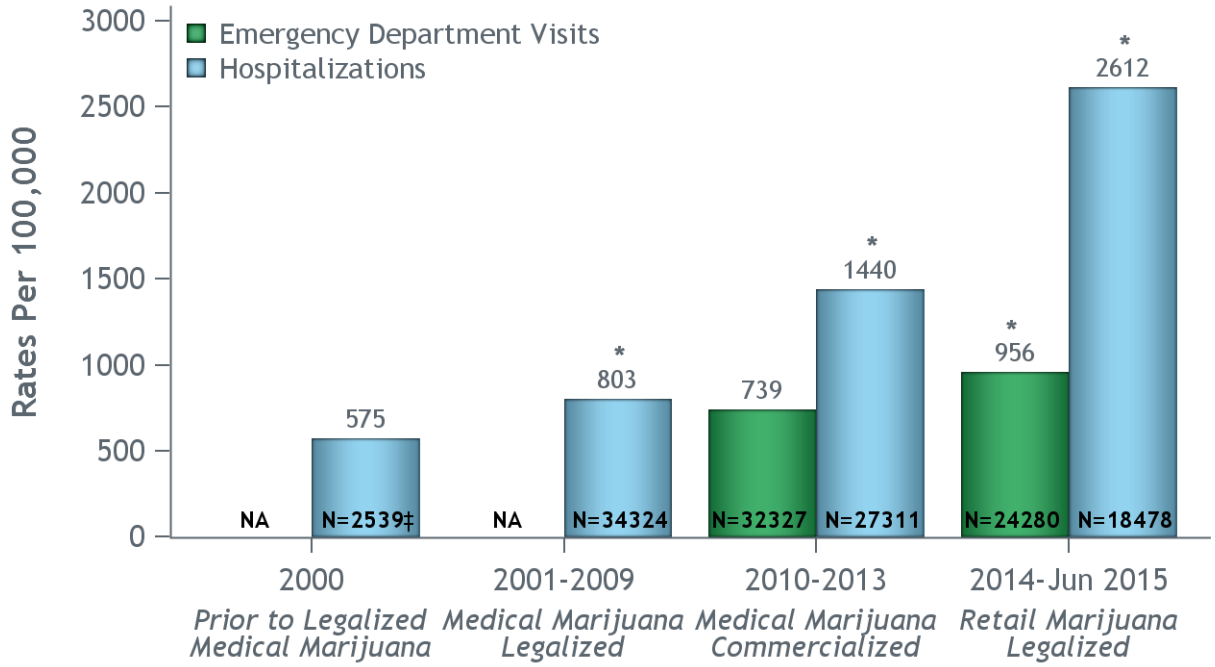
Major Findings

- Rates of HD with possible marijuana exposures, diagnoses, or billing codes showed an increasing trend beginning in 2001 with the highest rate of HD in January through June 2015 of 2,942 per 100,000 HD.
- Rates of ED visits with possible marijuana exposures, diagnoses, or billing codes showed an increasing trend from 2012 to 2014 and then decreased from 2014 to January through June of 2015 by 26%.
- The highest increases in rates were from 2013 to 2014 of 27% for HD and 2012 to 2013 of 25% for ED visits.

Data Details

Colorado Hospital Association (CHA), 2014 data was January 1, 2014 through June 30, 2014. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

Figure 6. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes† per 100,000 HD and ED Visits by Legalization Eras in Colorado.



*Rate significantly increased from previous time period with a p-value <0.001.
†ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD and ED visits with possible marijuana exposure, diagnoses, or billing codes.
‡The Ns are the total number of HD or ED visits with possible marijuana exposures, diagnoses, or billing codes in the specified time period.

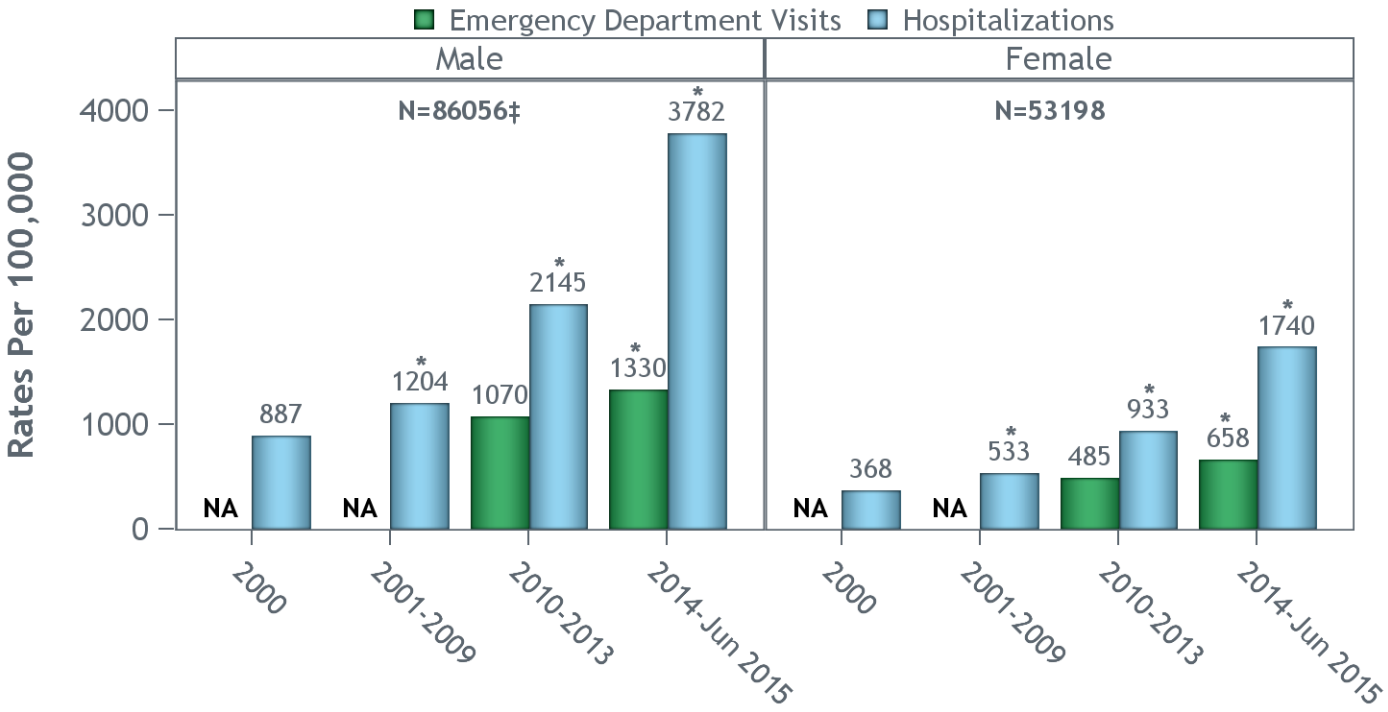
Major Findings

- Rates of HD with possible marijuana exposures, diagnoses, or billing codes significantly increased by each time period from 2000 to 2014 through June 2015 with the highest increase of 81.4% from 2010-2013 to 2014 through June 2015.
- Rates of ED visits significantly increased by 29.4% from 2011-2013 to 2014 through June 2015 from 739 per 100,000 to 956 per 100,000.
- The highest rates for both HD and ED visits with possible marijuana exposures, diagnoses, or billing codes were in 2014 through June 2015 of 2,612 and 956 per 100,000 HD and ED visits respectively.

Data Details

- Data source: Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015.
- NA=Data not available.
- An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

Figure 7. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes† per 100,000 HD and ED Visits by Legalization Eras in Colorado and Gender.



*Rate significantly increased from previous time period with a p-value <0.001.
†ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD and ED visits with possible marijuana exposure, diagnoses, or billing codes.
‡The Ns are the total number of HD or ED visits with possible marijuana exposures, diagnoses, or billing codes in each gender.

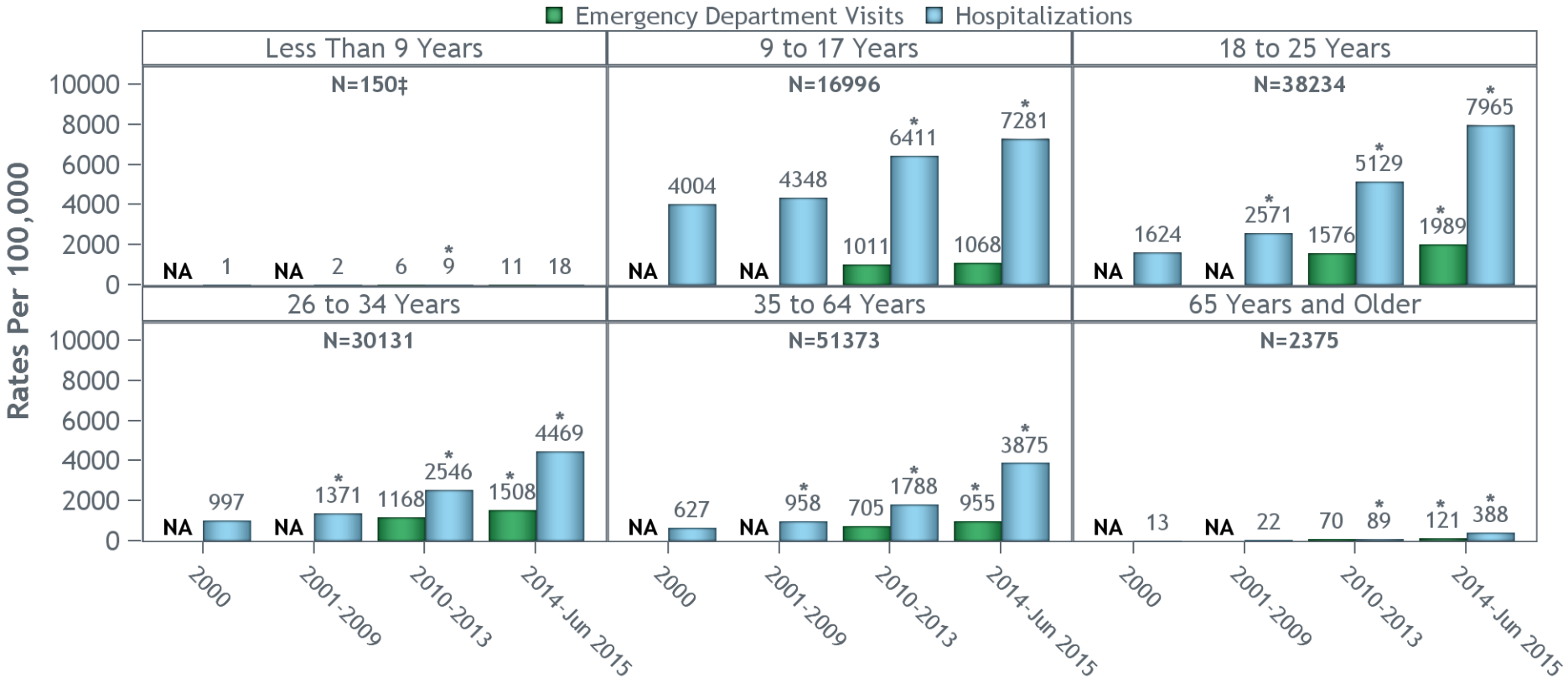
Major Findings

- Rates of HD with possible marijuana exposures, diagnoses, or billing codes significantly increased by each time period from year 2000 to 2014 through June 2015 for both males and females.
- Rates of ED visits significantly increased from 2011-2013 to 2014 through June 2015 for males and females.
- Males had consistently higher rates of HD and ED visits with possible marijuana exposures, diagnoses, or billing codes across time periods.

Data Details

- Data source: Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015.
- NA=Data not available.
- An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

Figure 8. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes† per 100,000 HD and ED Visits by Legalization Eras in Colorado and Age.



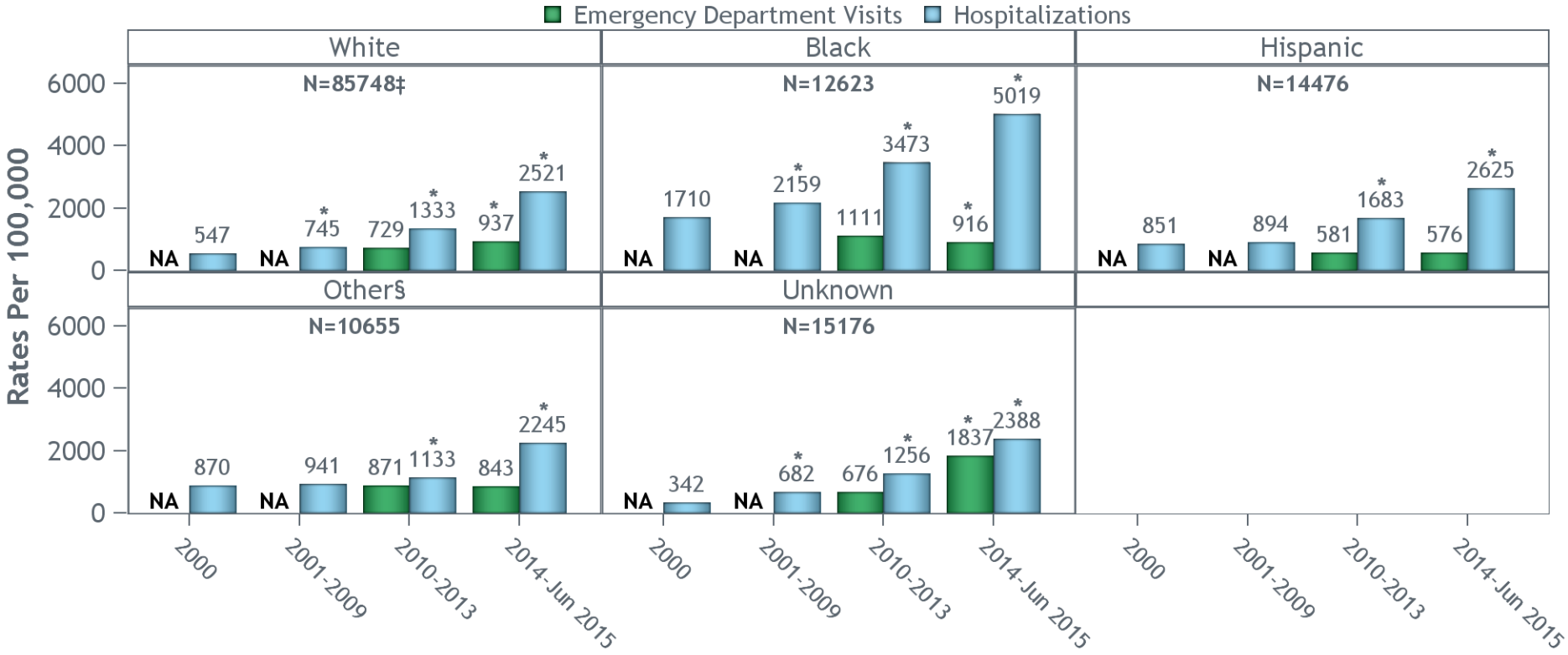
*Rate significantly increased from previous time period with a p-value <0.001.
†ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD and ED visits with possible marijuana exposure, diagnoses, or billing codes.
‡The Ns are the total number of HD or ED visits with possible marijuana exposures, diagnoses, or billing codes in each age group.

Major Findings

- Rates of HD with possible marijuana exposures, diagnoses, or billing codes significantly increased for all age groups from 2001-2009 to 2010-2013 and for those 18 and older for 2010-2013 to 2014 through June 2015.
- Rates of ED visits with possible marijuana exposures, diagnoses, or billing codes significantly increased from 2011-2013 to 2014 through June 2015 for all age groups except those less than 9 years and 9 to 17 years old.

Data Details: Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

Figure 9. Rates of Hospitalizations (HD) and Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes† per 100,000 HD and ED Visits by Legalization Eras in Colorado and Race/Ethnicity.



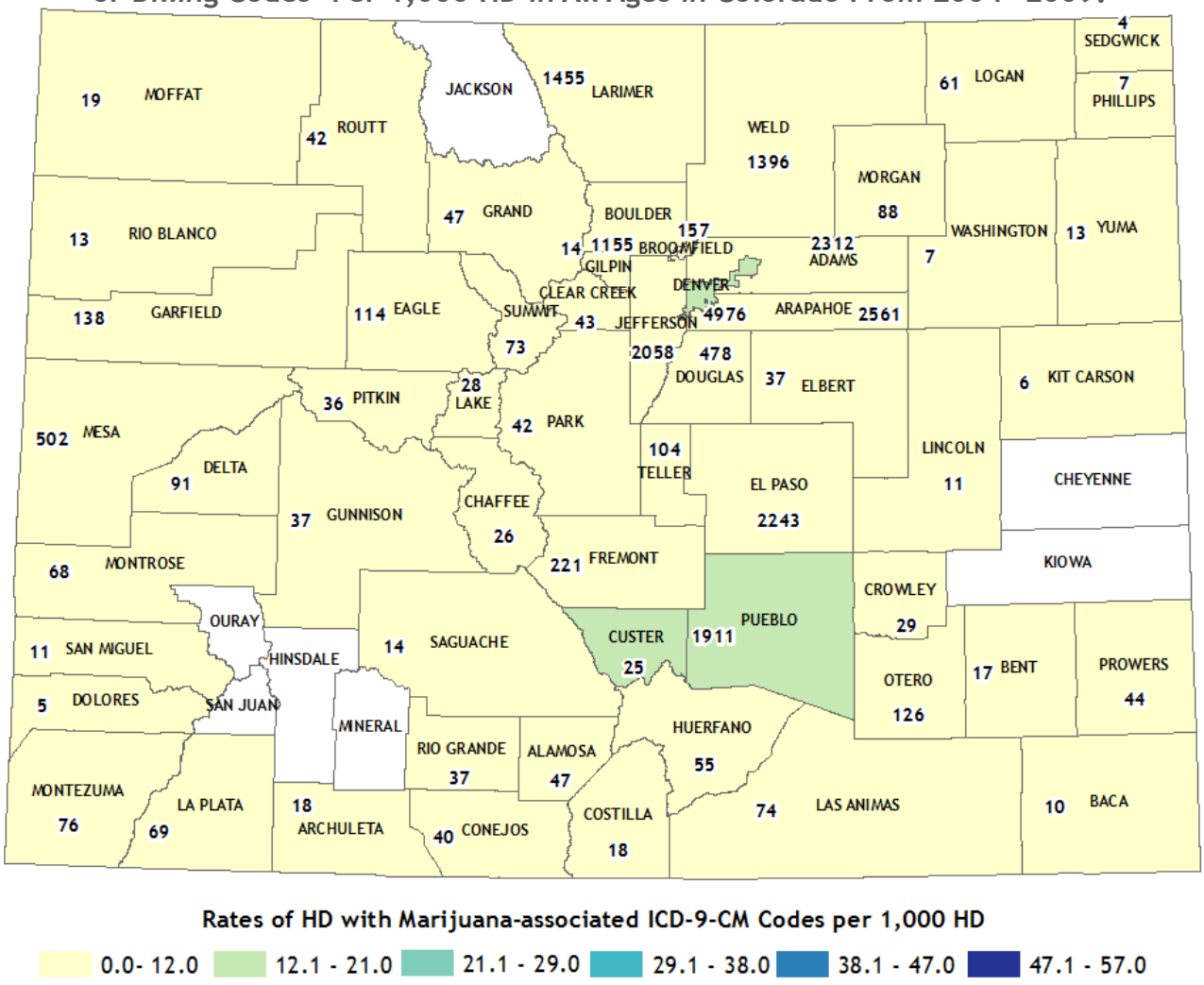
*Rate significantly increased from previous time period with a p-value <0.001.
†ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD and ED visits with possible marijuana exposure, diagnoses, or billing codes.
‡The Ns are the total number of HD or ED visits with possible marijuana exposures, diagnoses, or billing codes for each race/ethnicity.
§Other race includes Asian, Native American, and other race.

Major Findings

- Rates of HD with possible marijuana exposures, diagnoses, or billing codes significantly increased by each time period from 2001-2009 to 2014 through June 2015 for White, Black, and Unknown races, and from 2010-2013 to 2014 through June 2015 for Hispanics and Other races.
- Rates of ED visits with possible marijuana exposures, diagnoses, or billing codes significantly increased from 2010-2013 to 2014 through June 2015 for White, Black, and Unknown races.

Data Details: Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

Map 2. Rates and Numbers[a] of Hospitalizations (HD) with Possible Marijuana Exposures, Diagnoses, or Billing Codes[b] Per 1,000 HD in All Ages in Colorado From 2004[c]-2009.



[a] The number inside the counties was the total number of HD with possible marijuana exposures, diagnoses, or billing codes in the specified county.
[b] ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD with possible marijuana exposure, diagnoses, or billing codes.

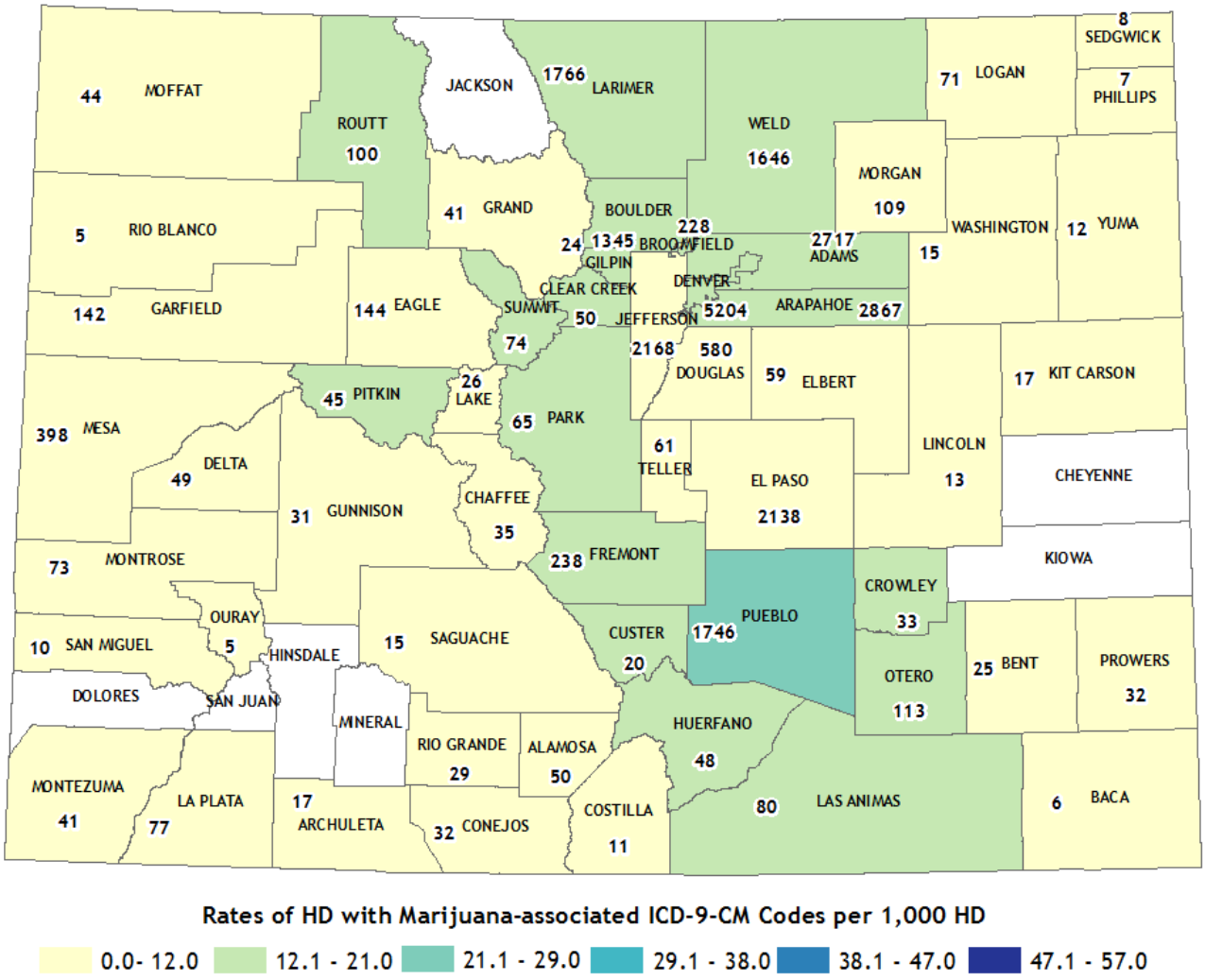
Major Findings

- Rates and numbers of HD with possible marijuana exposures, diagnoses, or billing codes were increased in urban areas compared to rural areas.
- The highest rates were in Pueblo (16 per 1,000 HD), Denver (13 per 1,000 HD), and Custer (12 per 1,000 HD) counties while the highest numbers of HD were in Denver (4,976 HD), Arapahoe (2,561 HD), and Adams (2,561 HD) counties.

Data Details

Data source: Colorado Hospital Association (CHA). Data geocoded from 2004 forward. Counties shown in white have no reported HD with possible marijuana exposures, diagnoses, or billing codes. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 1,000 HD.

Map 3. Rates and Numbers[a] of Hospitalizations (HD) with Possible Marijuana Exposures, Diagnoses, or Billing Codes[b] per 1,000 Hospitalizations in All Ages in Colorado from 2010-2013.



[a] The number inside the county was the total number of HD with possible marijuana exposures, diagnoses, or billing codes in the specified county.
[b] ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD with possible marijuana exposure, diagnoses, or billing codes.

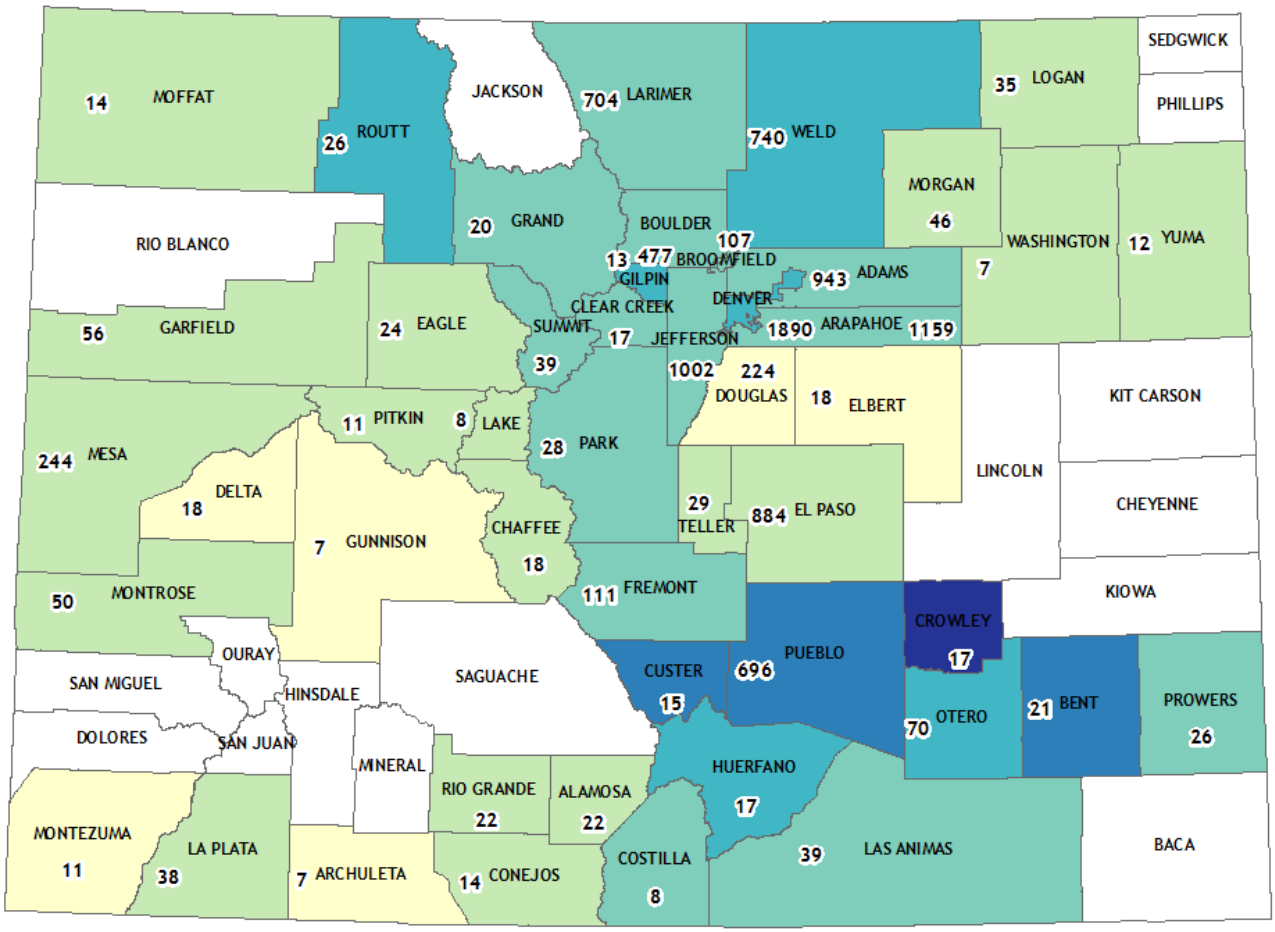
Major Findings

- Rates and numbers of HD with possible marijuana exposures, diagnoses, or billing codes were increased in urban areas compared to rural areas.
- The highest rates were in Pueblo county (24 HD per 1,000); however, the highest number of HD was in Denver county (5,204).

Data Details

Data source: Colorado Hospital Association (CHA). Counties shown in white have no reported HD with possible marijuana exposures, diagnoses, or billing codes. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 1,000 HD.

Map 4. Rates and Numbers[a] of Hospitalizations (HD) with Possible Marijuana Exposures, Diagnoses, or Billing Codes[b] per 1,000 Hospitalizations in All Ages in Colorado in 2014.



[a] The number inside the county was the total number of HD with possible marijuana exposures, diagnoses, or billing codes in the specified county.
[b] ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD with possible marijuana exposure, diagnoses, or billing codes.

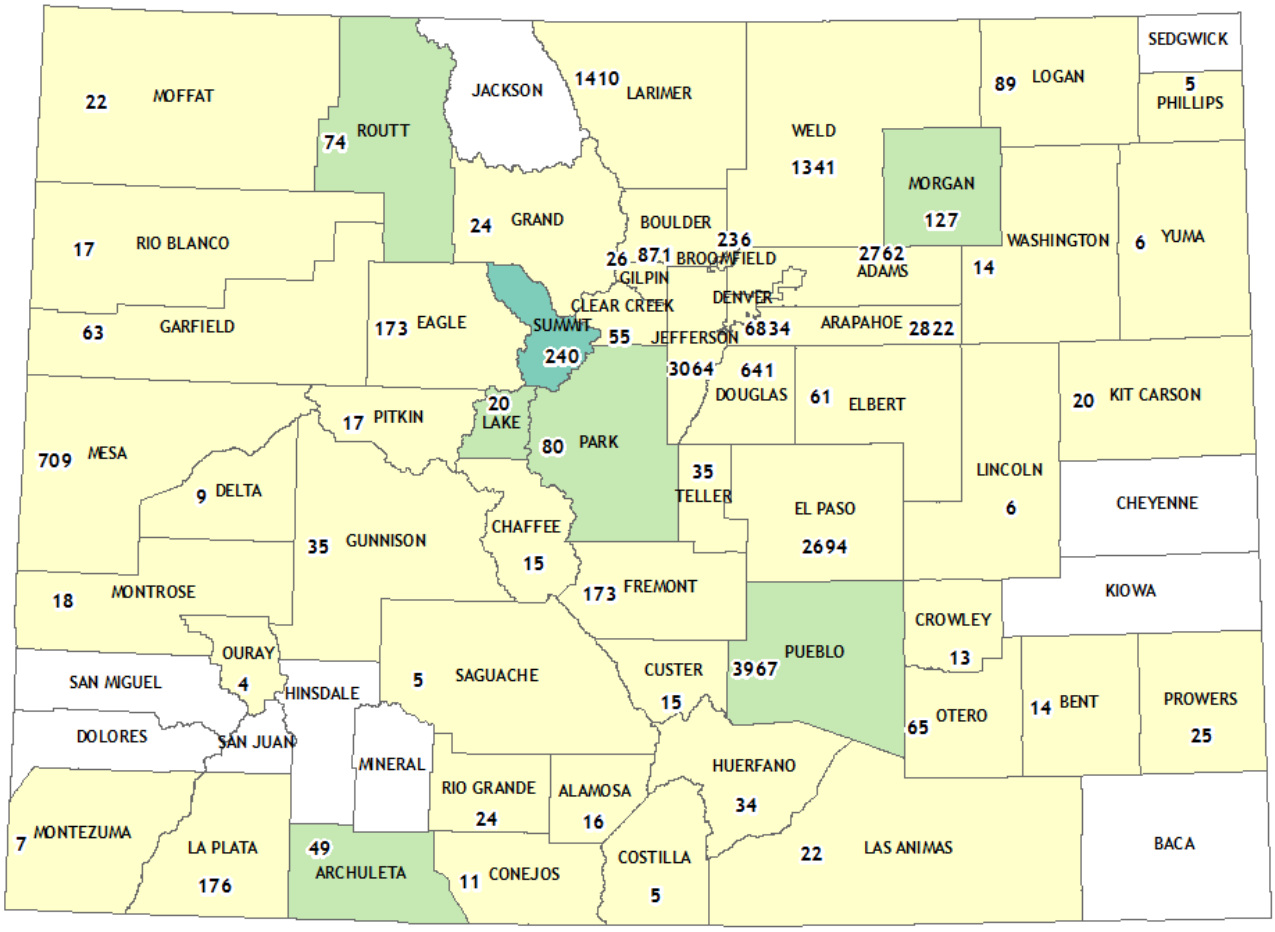
Major Findings

- Numbers of HD with possible marijuana exposures, diagnoses, or billing codes were increased in urban areas compared to rural areas.
- The highest rates of HD were in Crowley county (56 HD per 1,000) while the highest numbers of HD were in Denver county (1,749 HD).

Data Details

Data source: Colorado Hospital Association (CHA). 2015 data has not been geocoded and therefore not included in the map. Counties shown in white have no reported HD with possible marijuana exposures, diagnoses, or billing codes. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 1,000 HD.

Map 5. Rates and Numbers[a] of Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes[b] per 1,000 ED Visits in All Ages in Colorado from 2011-2013.



[a] The number inside the county was the total number of HD with possible marijuana exposures, diagnoses, or billing codes in the specified county.
[b] ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD with possible marijuana exposure, diagnoses, or billing codes.

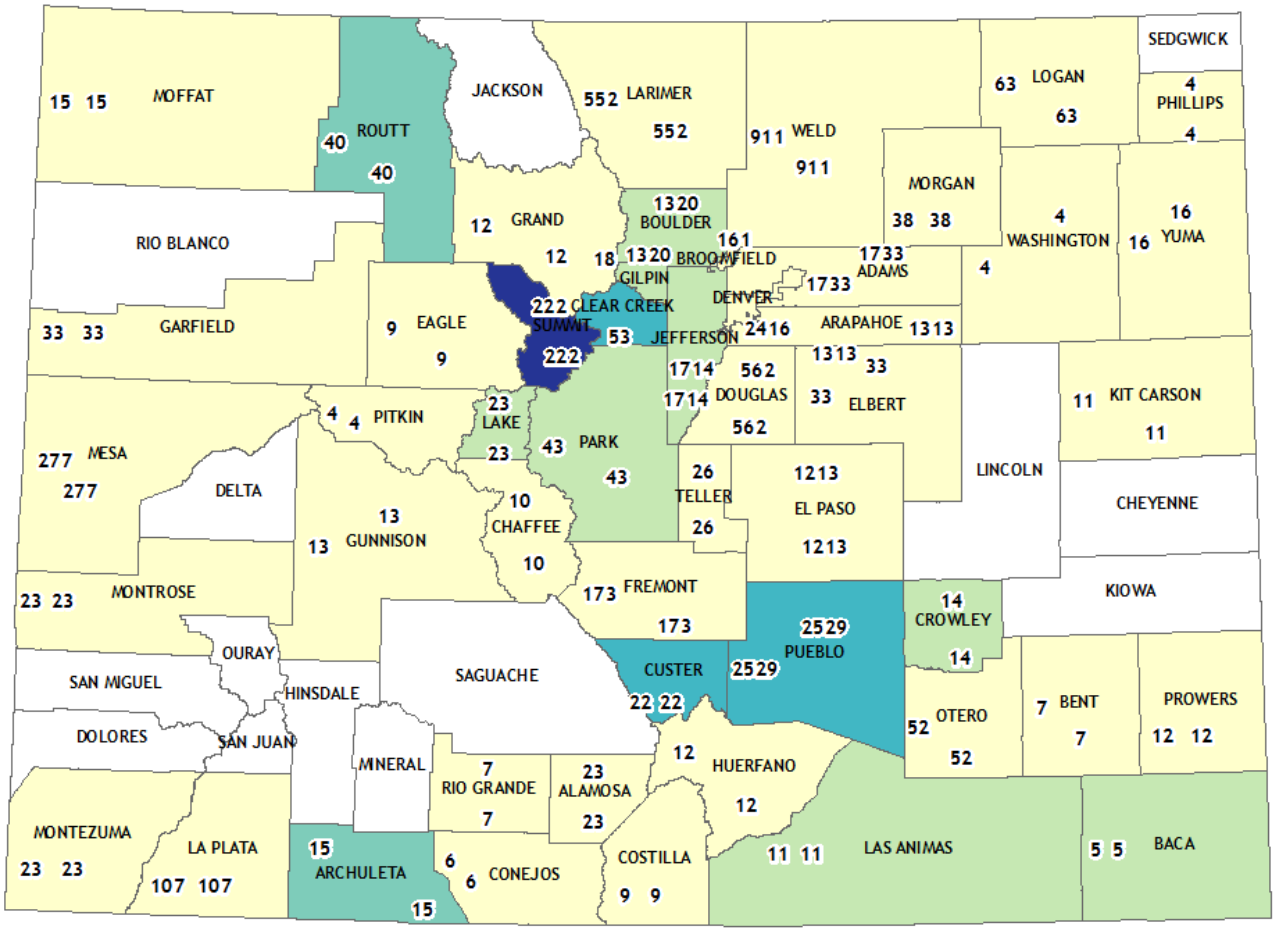
Major Findings

- The rates of ED visits remained fairly constant from urban to rural counties; however, the numbers of ED visits were higher in urban counties compared to rural counties.
- The highest rates of ED visits were observed in Summit (21 ED visits per 1,000), Routt (17 ED visits per 1,000), Pueblo (17 ED visits per 1,000), Lake (13 ED visits per 1,000), Park (13 ED visits per 1,000), and Archuleta (13 ED visits per 1,000) counties, while the highest numbers of ED visits were in Denver (6,834 ED visits) and Pueblo (3,967 Ed vistis) counties.

Data Details

Data source: Colorado Hospital Association (CHA). Counties shown in white have no reported HD with possible marijuana exposures, diagnoses, or billing codes. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 1,000 HD.

Map 6. Rates and Numbers[a] of Emergency Department (ED) Visits with Possible Marijuana Exposures, Diagnoses, or Billing Codes[b] per 1,000 Hospitalizations in All Ages in Colorado in 2014.



Rates of ED Visits with Marijuana-associated ICD-9-CM Codes per 1,000 ED Visits

0.0- 12.0 | 12.1 - 21.0 | 21.1 - 29.0 | 29.1 - 38.0 | 38.1 - 47.0 | 47.1 - 57.0

[a] The number inside the county was the total number of HD with possible marijuana exposures, diagnoses, or billing codes in the specified county.
[b] ICD-9-CM codes 305.2, 304.3, 969.6, and E854.1 were used to determine HD with possible marijuana exposure, diagnoses, or billing codes.

Major Findings

- The rate of ED visits increased in Adams, Alamosa, Arapahoe, Archuleta, Baca, Boulder, Broomfield, Chaffee, Clear Creek, Costilla, Crowley, Custer, Dolores, Douglas, El Paso, Elbert, Fremont, Garfield, Gilpin, Grand, Jefferson, Kit Carson, La Plata, Lake, Las Animas, Logan, Mesa, Moffat, Montezuma, Montrose, Morgan, Otero, Park, Phillips, Pueblo, Routt, Summit, Teller, Washington, Weld, and Yuma counties from 2011-2013.
- The highest rates of ED visits were observed in Summit county (56 ED visits per 1,000), while the highest numbers of ED visits were in Pueblo county (2,529 ED visits).

Data Details

Data source: Colorado Hospital Association (CHA). 2015 data has not been geocoded and therefore not included in the map. Counties shown in white have no reported HD with possible marijuana exposures, diagnoses, or billing codes. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 1,000 HD.

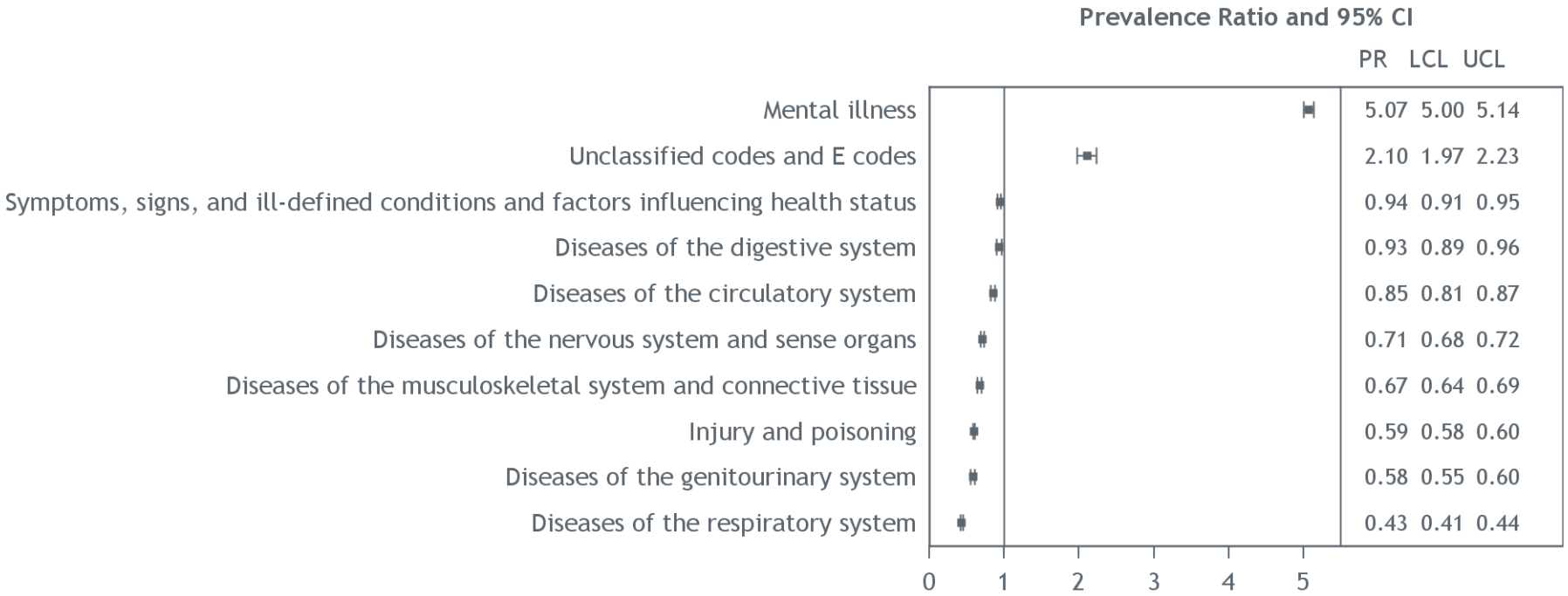


Figure 10. Top Ten Prevalence Ratios and 95% Confidence Intervals (CI) of Primary Diagnosis Categories Among Emergency Department (ED) Visits for ED Visits with Marijuana-associated ICD-9-CM Codes* Compared to ED Visits without Marijuana-associated ICD-9-CM Codes in Colorado from 2011 through June 2015.

*ED visits with marijuana-associated ICD-9-CM codes included 304.3, 305.2, 969.6, and E854.1 in the any of the listed 30 diagnosis codes.
†PR=Prevalence Ratio, CI=Confidence Interval, LCL=Lower Confidence Limit, UCL=Upper Confidence Limit

Major Findings

- The prevalence of primary diagnosis category of mental illness among ED visits with marijuana-associated codes was fivefold higher (PR: 5.07, 95% CI: 5.00-5.14) than the prevalence of primary diagnosis category of mental illness among ED visits without marijuana-associated codes.
- The prevalence of primary diagnosis category of unclassified codes and E codes among ED visits with marijuana-associated codes was twofold higher (PR: 2.10, 95% CI: 1.97-2.23) than the prevalence of primary diagnosis category of unclassified codes and E codes among ED visits without marijuana-associated codes.
- The top three primary diagnosis categories among ED visits with marijuana-associated codes were mental illness (29.1%), symptoms, signs, and ill-defined conditions and factors influencing health status (13.7%), and injury and poisoning (11.6%), while the top three primary diagnosis categories among ED visits without marijuana-associated codes were injury and poisonings (19.6%), symptoms, signs, and ill-defined conditions and factors influencing health status (14.6%), and diseases of the respiratory system (13.7%).
- See Table 1 in Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results for more details.

Data Details

Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

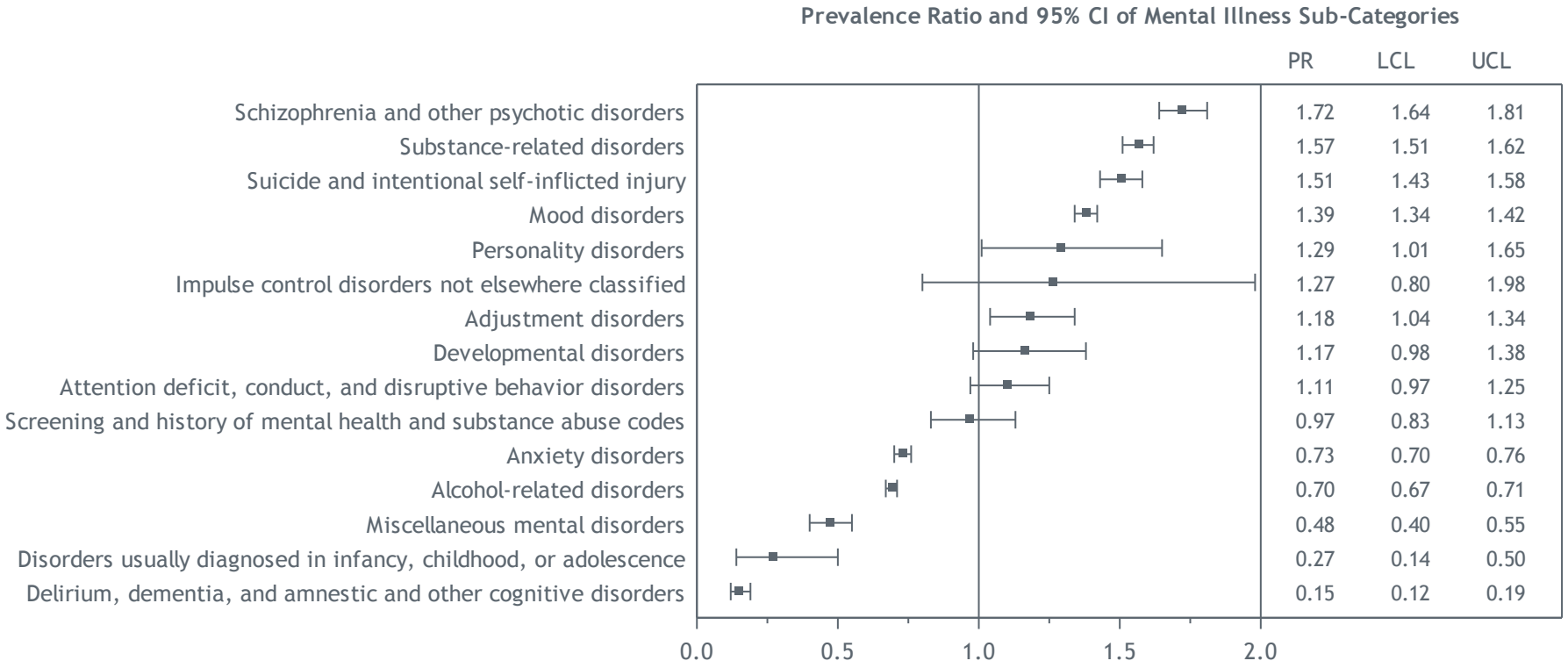


Figure 11. Prevalence Ratios and 95% Confidence Intervals (CI) of Mental Illness Sub-Categories Among Emergency Department (ED) Visits for ED Visits with Marijuana-associated ICD-9-CM Codes* Compared to ED Visits without Marijuana-associated ICD-9-CM Codes in Colorado from 2011 through June 2015.

*Marijuana-associated ICD-9-CM codes included 304.3, 305.2, 969.6, and E854.1 in the any of the listed 30 diagnosis codes.
PR=Prevalence Ratio, CI=Confidence Interval, LCL=Lower Confidence Limit, UCL=Upper Confidence Limit

Major Findings

- Within ED visits with a primary diagnosis category of mental illness, the prevalence of schizophrenia and other psychotic disorders (PR:1.72, 95% CI:1.64-1.81), substance-related disorders (PR:1.57, 95% CI:1.51-1.62), suicide and intentional self-inflicted injury (PR:1.51, 95% CI:1.43-1.58), mood disorders (PR:1.39, 95% CI:1.34-1.42), personality disorder (PR:1.29, 95% CI:1.01-1.65), and adjustment disorders (PR:1.18, 95% CI:1.04-1.34) was increased among ED visits with marijuana-associated ICD-9-CM codes compared to those without marijuana-associated ICD-9-CM codes.
- The prevalence of miscellaneous mental disorders, disorders usually diagnosed in infancy, childhood, or adolescence, delirium, dementia, and amnestic and other cognitive disorders, anxiety disorders, and alcohol-related disorders was decreased in ED visits with marijuana-associated ICD-9-CM codes compared to ED those without marijuana-associated ICD-9-CM codes.
- See Table 2 in **Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results** for more details.

Data Details

Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

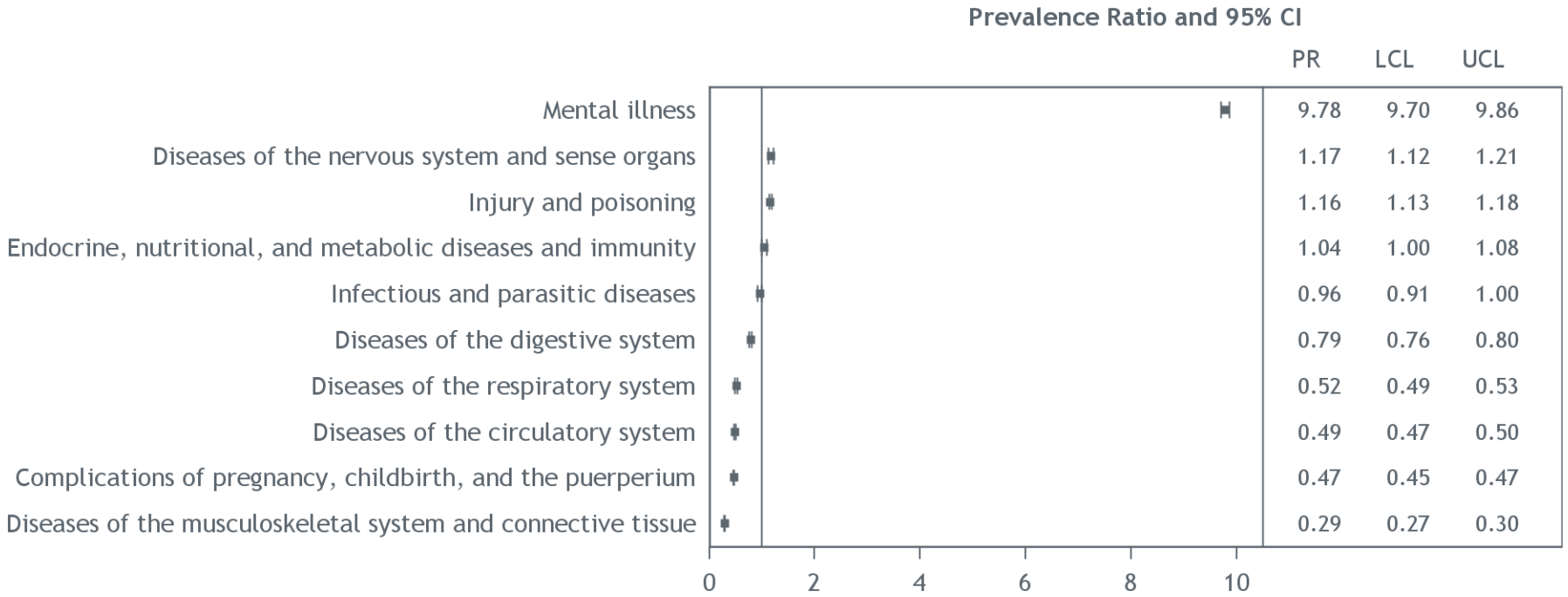


Figure 12. Top Ten Prevalence Ratios and 95% Confidence Intervals (CI) of Primary Diagnosis Categories Among Hospitalizations (HD) for HD with Marijuana-associated ICD-9-CM Codes* Compared to HD without Marijuana-associated ICD-9-CM Codes in Colorado from 2000 through June 2015.

*Hospitalizations with marijuana-associated ICD-9-CM codes included 304.3, 305.2, 969.6, and E854.1 in any of the listed 30 diagnosis codes.
†PR=Prevalence Ratio, CI=Confidence Interval, LCL=Lower Confidence Limit, UCL=Upper Confidence Limit

Major Findings

- The prevalence of primary diagnosis category of mental illness among HD with marijuana-associated codes was nine fold higher (PR: 9.78, 95% CI: 9.70-9.86) than the prevalence of primary diagnosis category of mental illness among HD without marijuana-associated codes.
- The prevalence of primary diagnosis category of diseases of the nervous system and sense organs among HD with marijuana-associated codes was 16 percent higher (PR: 1.17, 95% CI: 1.12-1.21) than the prevalence of primary diagnosis category of diseases of the nervous system and sense organs among HD without marijuana-associated codes.
- The prevalence of primary diagnosis category of injury and poisoning among HD with marijuana-associated codes was 14 percent higher (PR: 1.16, 95% CI: 1.13-1.18) than the prevalence of primary diagnosis category of injury and poisonings among HD without marijuana-associated codes.
- The top three primary diagnosis categories among HD with marijuana-associated codes were mental illness (46.5%), injury and poisoning (10.4%), and disease of the digestive system (7.01%), while the top three primary diagnosis categories among HD without marijuana-associated codes were complications of pregnancy, childbirth, and the puerperium (14.8%), certain conditions originating in the perinatal period (13.9%), and diseases of the circulatory system (12.2%).
- See Table 3 in **Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results** for more details.

Data Details: Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

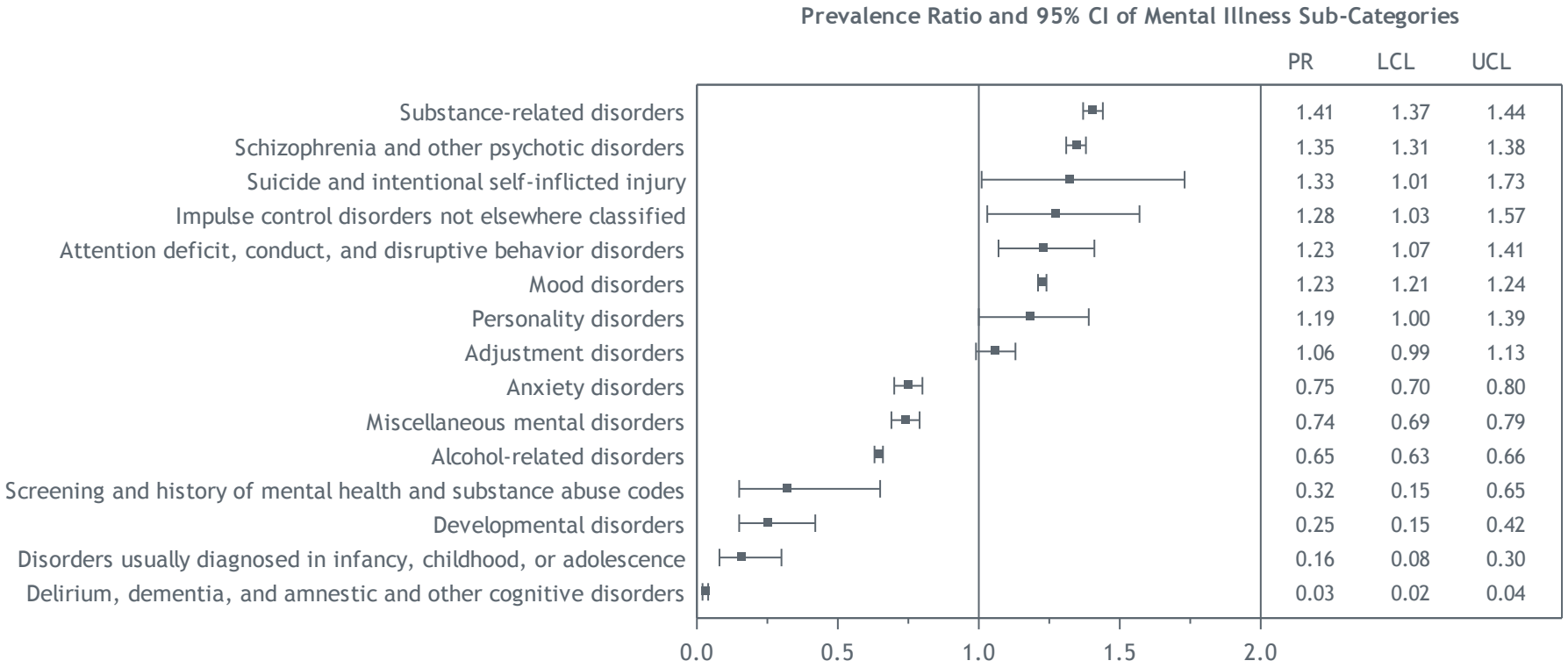


Figure 13. Prevalence Ratios and 95% Confidence Intervals (CI) of Mental Illness Sub-Categories Among Hospitalizations (HD) for HD with Marijuana-associated ICD-9-CM Codes* Compared to HD without Marijuana-associated ICD-9-CM Codes in Colorado from 2000 through June 2015.

*Marijuana-associated ICD-9-CM codes included 304.3, 305.2, 969.6, and E854.1 in the any of the listed 30 diagnosis codes.
PR=Prevalence Ratio, CI=Confidence Interval, LCL=Lower Confidence Limit, UCL=Upper Confidence Limit

Major Findings

- Within HD with a primary diagnosis category of mental illness, the prevalence of suicide and intentional self-inflicted injury (PR:1.33, 95% CI:1.01-1.73), substance-related disorders (PR:1.41, 95% CI:1.37-1.44), schizophrenia and other psychotic disorders (PR:1.35, 95% CI:1.31-1.38), personality disorders (PR:1.19, 95% CI:1.01-1.39), mood disorders (PR:1.23, 95% CI:1.21-1.24), impulse control disorders not elsewhere classified (PR:1.28, 95% CI:1.03-1.57), and attention deficit, conduct, and disruptive behavior disorders (PR:1.23, 95% CI:1.07-1.41) was increased among HD with marijuana-associated ICD-9-CM codes compared to those without marijuana-associated codes.
- The prevalence of screening and history of mental health and substance abuse codes, miscellaneous mental disorders, disorders usually diagnosed in infancy, childhood, or adolescence, development disorders, delirium, dementia, and amnestic and other cognitive disorders, anxiety disorders, and alcohol-related disorders was decreased in HD with marijuana-associated ICD-9-CM codes compared to HD without marijuana-associated ICD-9-CM codes.
- See Table 4 in **Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results** for more details.

Data Details

Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

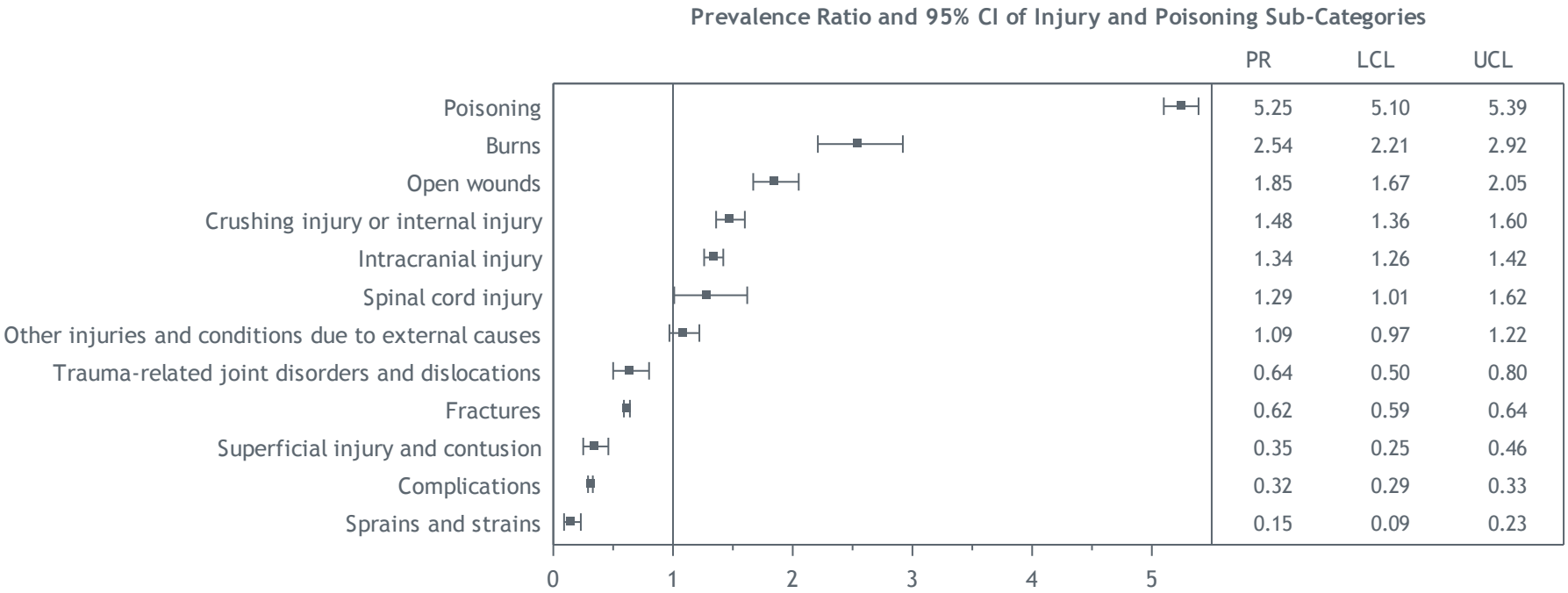


Figure 14. Prevalence Ratios and 95% Confidence Intervals (CI) of Injury and Poisoning Sub-Categories Among Hospitalizations (HD) for HD with Marijuana-associated ICD-9-CM Codes* Compared to HD without Marijuana-associated ICD-9-CM Codes in Colorado from 2000 through June 2015.

*Marijuana-associated ICD-9-CM codes included 304.3, 305.2, 969.6, and E854.1 in the any of the listed 30 diagnosis codes.
PR=Prevalence Ratio, CI=Confidence Interval, LCL=Lower Confidence Limit, UCL=Upper Confidence Limit

Major Findings

- Within HD with a primary diagnosis category of injury and poisoning, the prevalence of poisonings (PR: 5.25, 95% CI: 5.10-5.39), burns (PR:2.54, 95% CI:2.21-2.92), open wounds (PR:1.85, 95% CI:1.67-2.05), crushing injury or internal injury (PR:1.48, 95% CI:1.36-1.60), and intracranial injury (PR:1.34, 95% CI:1.26-1.42) was increased among HD with marijuana-associated ICD-9-CM codes compared to HD without marijuana-associated ICD-9-CM codes.
- The prevalence of superficial injury and contusion, sprains and strains, trauma-related joint disorders and dislocations, fractures, and complications was decreased among HD with marijuana-associated ICD-9-CM codes compared to HD without marijuana-associated ICD-9-CM codes.
- See Table 4 in Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results for more details.

Data Details

Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.

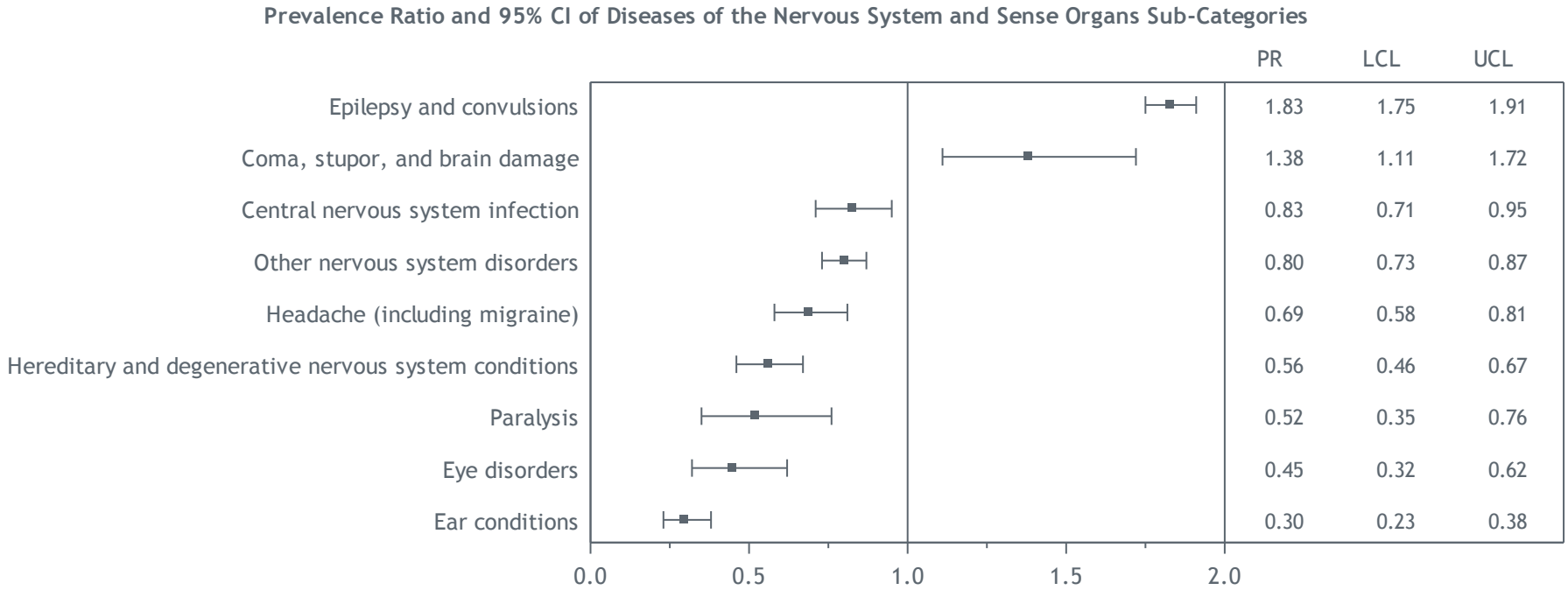


Figure 15. Prevalence Ratios and 95% Confidence Intervals (CI) of Diseases of the Nervous System and Sense Organs Sub-Categories Among Hospitalizations (HD) for HD with Marijuana-associated ICD-9-CM Codes* Compared to HD without Marijuana-associated ICD-9-CM Codes in Colorado from 2000 through June 2015.

*Marijuana-associated ICD-9-CM codes included 304.3, 305.2, 969.6, and E854.1 in the any of the listed 30 diagnosis codes.
PR=Prevalence Ratio, CI=Confidence Interval, LCL=Lower Confidence Limit, UCL=Upper Confidence Limit

Major Findings

- Within HD with a primary diagnosis category of diseases of the nervous system and sense organs, the prevalence of epilepsy and convulsions (PR: 1.83, 95% CI: 1.75-1.91), and coma, stupor, and brain damage (PR: 1.38, 95% CI: 1.11-1.72) was increased among HD with marijuana-associated ICD-9-CM codes compared to HD without marijuana-associated ICD-9-CM codes.
- The prevalence of paralysis, other nervous system disorders, hereditary and degenerative nervous system conditions, headache (including migraine), eye disorders, ear conditions, and central nervous system infection was decreased among HD with marijuana-associated ICD-9-CM codes compared to those without.
- See Table 4 in **Appendix, Monitoring Possible Marijuana Related Health Effects, Colorado Hospital Association Data, 2000-2015, Analysis Methods and Results** for more details.

Data Details

Colorado Hospital Association (CHA), 2015 data was January 1, 2015 through June 30, 2015. NA=Data not available. An individual can be represented more than once in the data; therefore, the rate was HD or ED visits with marijuana codes per 100,000 total HD or ED visits.