Indirect Impacts of City Medical Marijuana Regulations on Adolescent Marijuana Use:
Investigating Perceived Risk and Perceived Accessibility of Marijuana Use as Mediating Factors

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Background
Adolescent Marijuana Use

- Although experimenting with alcohol and drugs and many other risk behaviors is normal during adolescence (Spear, 2000), adolescence is also the crucial intervention point for prevention of harm from substance use.

- Any and all substance use among adolescents can be considered a problem, due to its impact on brain development (Volkow, Wang, Fowler, & Tomasi, 2015), associated health risks (Volkow, 2014), and its negative impacts on future prospects for education and employment (Bachman, 2008; Weiss, 2012).
Dynamic Marijuana Policy

• Policy approaches to reducing adolescent substance use are more effective than approaches such as health education or family interventions (Frieden, 2010), particularly to address legal substances such as alcohol (Grube, 1997; Kenkel and Manning, 1996; Stockwell and Gruenewald, 2001; Wagenaar, 1993) tobacco (Chaloupka et al., 2012), and in a steadily increasing number of states, marijuana.
  – E.g, social host ordinances
  – Retailer training and licensing
  – Conditional use permits

• In addition to their direct impact on behavior, local policies regulating substance use shape attitudes about the social acceptability of drug and alcohol misuse and abuse (Holder, 1999, 2002).

• A chief concern among public health professionals is that increased availability and social acceptance of marijuana will lead to more youth use (CA Blue Ribbon Commission on Marijuana Policy, 2015).
How will marijuana policies that regulate adult access impact youth?

- Adolescents primarily access marijuana through social sources and the black market (King, Merianos, & Vidourek, 2016), so policy changes allowing greater legal access for adults may or may not impact on direct youth access to marijuana, but we need to consider indirect effects as well.

- Decades of alcohol and tobacco research show that youth use of legal substances is higher in places where there is easier access for adults, despite age restrictions (Bryden et al., 2012).

- An unknown portion of medical marijuana intended for adults is known to get into the hands of children and adolescents. For example, a study of adolescents in drug treatment found that 75% had used someone else’s medical marijuana within the previous year (Salomonsen-Sautel, 2012).
Changing Youth Perceptions of Marijuana

• Changing attitudes to see marijuana use as more acceptable have been noted among youth populations (Johnson et al., 2014), but whether changes in attitudes are the result of policy changes or of a general secular change in attitudes toward marijuana is difficult to determine.

• A study in California found that decriminalization of marijuana possession in 2010 was followed by a 25% increase in 12th graders’ likelihood of using marijuana, a 20% decrease in their likelihood to perceive regular use as dangerous, and a 20% decrease in the likelihood of strong disapproval of marijuana use (Miech et al., 2015).
  – However, these attitudes were also in evidence among the same students two years earlier, when the law had been proposed and approved, but not yet enacted.
  – More liberal marijuana policies may enhance impressions among adolescents that marijuana use is socially acceptable and/or decrease perceptions of harm (Miech et al., 2015).
Marijuana Policy in California

- California has 58 counties and 482 incorporated cities across the state, each with the option to create its own policies regulating marijuana.

- This creates opportunities to address negative outcomes like youth use and excessive use using local regulations.

- Research is sparse on the impacts of these different approaches to marijuana regulation at the local level (cities or counties).
Timeline for California Marijuana Policy and Study Period

Study Period: 2014/2015 School Year

1996
CA Compassionate Use Act
Growing and Sharing Marijuana Legalized for Medical Use

2004
CA Senate Bill 420
First Storefront Dispensaries

2006
First City Medical Marijuana Ordinance in LA County

2016
CA Medical Cannabis Regulation and Safety Act enacted
Comprehensive Medical Marijuana Regulations Developed

2017
Prop 24, the Adult Use Marijuana Act enacted
Legalized non-medical use for adults
Marijuana Policy in LA County

• LA County is home to almost 10 million people (9,818,605).
• There are 88 cities in LA County, 6 of which currently allow medical marijuana dispensaries.
• Since this includes LA (with 3.9 million people); 4,197,817 million (43%) of LA County residents live in a city that allows storefront marijuana outlets.
• All 88 cities are making decisions now about how they will regulate recreational marijuana before state licenses for non-medical retail outlets are issued in 2018.
Statement of the Problem

• Marijuana use is not safe for children and adolescents (American Association of Pediatricians, 2014).

• Many regulatory decisions about marijuana are made at the local level.

• Although hundreds of local jurisdictions in California have passed ordinances to regulate marijuana beyond what the state law requires, to date no known research has compared the impacts of these various approaches to marijuana regulation on adolescent marijuana use.
Purpose

• Investigate the influence of city policies regulating medical marijuana dispensaries on students’ perceptions of the risk of marijuana use and how easy it is to get.
• Investigate the impact that these perceptions have on students’ marijuana use.
Focal Relationship

Do city policies that allow marijuana dispensaries impact recent marijuana use among the city’s students?
Research Questions

• How do civic marijuana policies impact students’ perceptions about the risks of marijuana use?

• How do civic marijuana policies impact students’ perceptions about the availability of marijuana?

• How do students’ perceptions of risk and availability in turn influence their patterns of marijuana use?
Mediated Relationship

Do city policies that allow dispensaries influence student marijuana use by way of their perceptions of risk and/or accessibility?
Theorized relationship: Perceived Risk

Student perceptions of the risk of marijuana use

City policy that allows marijuana outlets

Student marijuana Use
Theorized relationship: Perceived Accessibility

Student perceptions of accessibility

City policy that allows marijuana outlets

Student marijuana Use
Hypothesis 1

I expect that students who attend school in cities that allow marijuana dispensaries will report...

- Lower perception of risks of marijuana use
- Greater perceptions of accessibility of marijuana

...compared to students in cities that do not allow dispensaries.
Hypothesis 2

I expect that students’ perception of risks of marijuana use and accessibility of marijuana will be a significant influence on whether or not they use marijuana.
Data Sources

Municipal Codes: City Marijuana Policies
California Healthy Kids Survey: Student Marijuana Use
Data: City Policies

- The 88 cities in Los Angeles County.
- Each city’s policy regulating medical marijuana dispensaries was abstracted from municipal codes.
- Noted the LA County policy for schools that are located in unincorporated LA County.
- Data collection started in August 2014 and is ongoing.
Data: California Healthy Kids Survey (CHKS)

- Self report
- Conducted at public schools throughout California
- Administered anonymously each year
- Designed to monitor trends in student health behavior
- Representative survey of 7th-, 9th-, and 11th-grade students for each school district
  - Smaller districts asked every student in every school to complete
  - Larger districts used a stratified random sampling plan
Study Population

• All CHKS respondents in LA County from school year 2014 – 2015
• High school only
• Sample: 46,028 respondents
  – Excluded 1,285 students with missing data for marijuana use.
  – Excluded 137 students who were younger than 13.
Outcome Variable 1: Recent Use

• Frequency of Recent Marijuana Use:
  – “During the past 30 days, on how many days did you use marijuana (pot, weed, grass, hash, bud)?” (emphasis in the original).
  – Response categories: “0 days”, “1 day”, “2 days”, “3-9 days”, “10-19 days”, “20 – 30 days”

• Dichotomized to any marijuana use within the previous 30 days (yes/no).
Outcome Variable 2: Lifetime Use

• Frequency of Lifetime Marijuana Use:
  – “During your life, how many times have you used the following substances?” (emphasis in the original).
  – Response categories: “0 times”, “1 time”, “2 times”, “3 times”, “4-6 times”, “7 or more times”

• Dichotomized to ever having used marijuana use (yes/no).
Mediator Variable: Perceived Risk

• Perceived Risk of Marijuana Use:
  – “How much do people risk harming themselves physically and in other ways when they do the following?” (refers to a list of substances that includes marijuana)
  – Asked about risk for occasional use and weekly use
  – Response categories: “Great”, “Moderate”, Slight”, and “None”

• Dichotomized to any risk of weekly use (yes/no).
Mediator Variable: Perceived Accessibility

• Perceived Ease of Accessing Marijuana
  – “How difficult is it for students in your grade to get any of the following substances if they really want them?” (refers to a list of substances that includes marijuana)

• Dichotomized to whether the student perceived marijuana as easy for students to access (yes/no).
Predictor Variable: City Policies Allowing Marijuana Dispensaries

• “Allowed” includes cities that explicitly allow and regulate storefront dispensaries.
• As of August 2014 and through August 2015, this included 4 cities in Los Angeles County.
Results

Descriptive Statistics
Exploratory Bivariate Analyses
Study Population

Student Demographic Characteristics

- Age
- Race/ethnicity
- Gender
Age Distribution

Percent of total

- 13
- 14
- 15
- 16
- 17
- 18 and older
Race/Ethnicity: Study Population

Study Population Racial/Ethnic Distribution (Percent of total)

- African American: 50%
- American Indian: 8%
- Asian: 12%
- Caucasian: 23%
- Mixed: 2%
- Pacific Islander: 4%

Hispanic Ethnicity Distribution

- Hispanic: 33%
- Non-Hispanic: 67%
Race/Ethnicity: Study Population

Study Population Racial/Ethnic Distribution (Percent of total)

- African American: 8
- American Indian: 6
- Asian: 9
- Caucasian: 9
- Hispanic: 1
- Mixed: 1
- Pacific Islander: 67

Total: 67
Gender

Percent of total

49.78  50.22

Male  Female
Student Marijuana Use

- Recent Marijuana Use At School: 6%
- Recent Marijuana Use: 15%
- Lifetime Marijuana Use: 28%

% Students
Student Marijuana Use by Gender

![Bar chart showing lifetime use and recent use at school by gender.]

- **Female**
  - Lifetime Use
  - Recent Use at School
  - Recent Use

- **Male**
  - Lifetime Use
  - Recent Use at School
  - Recent Use

- **Legend**:
  - Green: Lifetime Use
  - Red: Recent Use at School
  - Blue: Recent Use
Student Perceptions

Risk of frequent use
Risk of occasional use
Ease of access
Perceived Risk of Marijuana Use

% Students

- 78%: Any risk of occasional use
- 38%: Great risk of occasional use
- 79%: Any risk of weekly use
- 43%: Great risk of weekly use
Perceived Accessibility of Marijuana

How difficult is it for students in your grade to get any of the following substances if they really want them?

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<td>Fairly...</td>
<td>6</td>
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<tr>
<td>Fairly Easy</td>
<td>19</td>
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<tr>
<td>Very Easy</td>
<td>38</td>
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Are Students’ Perceptions Predictors of Recent Marijuana Use?

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<tr>
<th>Perception</th>
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<th>Prob</th>
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<tr>
<td>Perceive any risk of weekly use</td>
<td>Chi-Square 1439.0938</td>
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<td>Perceive it &quot;easy&quot; to get marijuana</td>
<td>Chi-Square 1356.0211</td>
<td>&lt;.0001</td>
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</table>

Non-Users

- Perceive any risk of occasional use: 81%
- Perceive any risk of weekly use: 82%
- Perceive it "easy" to get marijuana: 77%

Recent Users

- Perceive any risk of occasional use: 60%
- Perceive any risk of weekly use: 61%
- Perceive it "easy" to get marijuana: 52%
Are Students’ Perceptions Predictors of Lifetime Marijuana Use?

<table>
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<th>Perceive any risk of occasional use</th>
<th>Perceive any risk of weekly use</th>
<th>Perceive it &quot;easy&quot; to get marijuana</th>
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<tr>
<td>statistic</td>
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<tr>
<td>Chi-Square</td>
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- 77 Non-Users
- 76 Lifetime Users
- 24 Non-Users
- 24 Lifetime Users
- 61 Non-Users
- 39 Lifetime Users
City Policies

Allow Dispensaries
Simple bivariate analysis

<table>
<thead>
<tr>
<th>Allows Dispensaries</th>
<th>Does Not Allow Dispensaries</th>
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<tbody>
<tr>
<td>Recent Use</td>
<td>Lifetime Use</td>
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<td>16</td>
<td>15</td>
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<tr>
<td>32</td>
<td>28</td>
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</table>

Chi-Square values:
- Allows Dispensaries: Chi-Square = 8.8761, Prob = 0.0029
- Does Not Allow Dispensaries: Chi-Square = 29.5514, Prob < 0.0001
Multilevel Analyses

Multilevel Logistic Regression
Baron & Kenny Test for Mediation
Analytical Approach

• Logistic regression.
• 2-level models to account for clustering in schools.
• Assess mediation using Baron and Kenny (1993) method.
• Construct a final logistic model to assess relative influence of student characteristics, school characteristics, and mediators and students’ marijuana use.
Multilevel Model

• 2-level logistic regression model accounts for students being clustered in schools.
  – Level 1 = student
  – Level 2 = school

• Use basic 2-level model for mediation tests.
Mediation Hypotheses

• **Focal relationship:** City policies allowing marijuana storefronts are associated with greater marijuana use among students attending school in that city.

• **Mediation Hypothesis 1:** City policies act on student marijuana use by reducing students’ perceptions of the risk of marijuana use.

• **Mediation Hypothesis 2:** City policies act on student marijuana use by increasing their perceptions of the accessibility of marijuana.
Mediation Step 1: Assess the focal relationship

How do regulations on medical marijuana dispensaries impact youth marijuana use?
Multilevel Analysis of Recent and Lifetime Marijuana Use by City Policy

- Non-significant relationship between students having recently used marijuana and whether their city allows marijuana storefronts (OR 1.191, p = 0.0989).
- Significant relationship between students having ever used marijuana and whether their city allows marijuana storefronts (OR 1.263, p = 0.0357).
- Hypothesized relationship is upheld only for lifetime marijuana use.
Mediation Hypothesis 1

City policies allowing marijuana dispensaries will result in students perceiving less risk from marijuana use. This in turn will lead to higher likelihood of marijuana use.
Mediation Step 2: Show that the causal variable is correlated with the mediator

Do city policies allowing marijuana dispensaries reduce student’s perceptions of the risk of marijuana use?
Allowing Dispensaries by Perception of Any Risk From Occasional Marijuana Use

• Non-significant relationship between policies allowing dispensaries and students perception of the risk of occasional use (OR 0.960, p = 0.5474).

• Hypothesized relationship between city policies and perceptions of risk is not supported.
Mediation Step 3: Show that the mediator affects the outcome variable

Does the relationship between city policies allowing marijuana dispensaries and student marijuana use change when accounting for the influence of students’ perception of the risk of marijuana use?
Allowing Dispensaries by Lifetime Marijuana Use When Accounting For Perceived Risk

• Focal relationship remains statistically significant (OR 1.267, p = .0284) and is almost unchanged compared to when perception of risk was not accounted for (OR 1.263, p = 0.0357).

• Hypothesis that city policies act on student marijuana use by reducing their perception of the risk of marijuana use is not supported.
Mediation Hypothesis 2

Do city policies allowing marijuana dispensaries increase student’s perceptions of how easy is it to access?
Allowing Dispensaries by Youth
Perceiving it Easy to Get Marijuana

• Non-significant relationship between policies allowing dispensaries and students perception of the risk of occasional use (OR 0.965, p = 0.6457).

• Hypothesized relationship between city policies and perceptions of ease of access is not supported.
Focal relationship remains statistically significant (OR 1.306, p = .0284) when compared to when perceived accessibility was not accounted for (OR 1.263, p = 0.0092).

Hypothesis 2, that city policies act on student marijuana use by increasing their ease of access, is not supported.
Mediation Results

• Neither mediation hypothesis was supported, meaning that while allowing dispensaries was associated with higher lifetime use, the association did not occur due to changed perceptions of the risk of marijuana use or changed perceptions of how easy it is to obtain.

• Mediators were associated with student marijuana use but not with city policies allowing dispensaries.
Final Regression Model

Assess the relative contribution of mediators to the relationship between city policies and lifetime marijuana use among students.
Empty Model

Measures the association of school on students’ lifetime marijuana use.

<table>
<thead>
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<th>Fit Statistic</th>
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<tr>
<td>Intercept</td>
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<td>0.5304</td>
<td>91</td>
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<td>-1.0954</td>
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Focal Relationship

City policy allowing dispensaries effect on students’ lifetime marijuana use, accounting for clustering in schools.

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<tr>
<td>Allow Dispensaries</td>
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Focal Relationship

City policy allowing dispensaries effect on students’ lifetime marijuana use, accounting for clustering in schools.

<table>
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<th>Estimate</th>
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<th>95% Confidence Limits</th>
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<td>41478</td>
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Focal Relationship + Mediators

City policy allowing dispensaries effect on students’ lifetime marijuana use, accounting for clustering in schools and including theorized mediators.

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Focal Relationship + Mediators

City policy allowing dispensaries effect on students’ lifetime marijuana use, accounting for clustering in schools and including theorized mediators.

| Effect              | Estimate | Standard Error | DF   | t Value | Pf > |t| | Alpha | Lower  | Upper  |
|---------------------|----------|----------------|------|---------|-------|--------|--------|--------|--------|
| Intercept           | -1.1429  | 0.06058        | 90   | -18.87  | <.0001| 0.05   | -1.2632| -1.0225|
| Allow Dispensaries  | 0.2713   | 0.09986        | 41476| 2.72    | 0.0066| 0.05   | 0.07557| 0.4670 |
| Perceive Easy Access| 1.2805   | 0.02631        | 41476| 50.07   | <.0001| 0.05   | 1.2304 | 1.3306 |
| Perceive Any Risk   | -0.9473  | 0.02631        | 41476| -36.00  | <.0001| 0.05   | -0.9989| -0.8957|
Focal Relationship + Mediators

City policy allowing dispensaries effect on students’ lifetime marijuana use, accounting for clustering in schools and including theorized mediators.

<table>
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<th>Estimate</th>
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<tr>
<td>Perceiving Access as “Easy”</td>
<td>3.598</td>
<td>41476</td>
<td>3.423</td>
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Focal Relationship + Mediators + Student Characteristics

City policy allowing dispensaries effect on students’ lifetime marijuana use, accounting for clustering in schools and including theorized mediators and student-level characteristics.

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### Focal Relationship + Mediators + Student Characteristics

| Effect               | Estimate | Standard Error | DF    | t Value | Pf > |t| | Alpha | Lower  | Upper  |
|----------------------|----------|----------------|-------|---------|-------|---|-------|--------|--------|
| Intercept            | -3.1913  | 0.1008         | 90    | -31.65  | <.0001| 0.05| -3.3916| -2.9910|
| Allow Dispensaries   | 0.3020   | 0.08761        | 40711 | 0.006   | 0.0006| 0.05| 0.1293 | 0.4727 |
| Perceive Easy Access | 1.2358   | 0.02622        | 40711 | 47.13   | <.0001| 0.05| 1.1844 | 1.2872 |
| Perceive Any Risk    | -0.9325  | 0.02689        | 40711 | -34.68  | <.0001| 0.05| -0.9852| -0.8798|
| Hispanic             | 0.2626   | 0.022928       | 40711 | 8.97    | <.0001| 0.05| 0.2052 | 0.3199 |
| Age                  | 0.2449   | 0.01060        | 40711 | 23.10   | <.0001| 0.05| 0.2241 | 0.2567 |
| Male                 | 0.06823  | 0.02397        | 40711 | 2.85    | 0.0044| 0.05| 0.02125| 0.1152 |
## Odds Ratio Estimates

<table>
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Focal Relationship + Mediators + Student Characteristics + School Norm for Marijuana Use

City policy allowing dispensaries effect on students’ lifetime marijuana use, accounting for clustering in schools and including theorized mediators and student-level characteristics.

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<th>Value</th>
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## Focal Relationship + Mediators + Student Characteristics + School Norm

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## Focal Relationship + Mediators + Student Characteristics + School Norm

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Findings

• City marijuana policies only had a significant influence on lifetime use.
  – Experimenting with or occasionally using marijuana carries lower risk of health harms than using monthly or more frequently.
  – City policies may have less effect on how often a student uses than it does on whether they experiment with marijuana use or use it occasionally.
Findings

• City marijuana policies that allow dispensaries did not significantly influence students’ perceptions of the health risk of marijuana use although this perception is associated with significantly lower odds of lifetime marijuana use.
  – Years of changing attitudes toward marijuana and its’ medical uses may influence young people’s perceptions of the risks of marijuana more than city policies.
  – State laws and national policy may be a greater determinant of youth perceptions of risk than city policies.
Findings

• Perceiving access to marijuana as easy was highly influential on students’ marijuana use although perceptions of access are not tied to whether a city allows dispensaries.
  – Consistent with research indicating that adolescents obtain marijuana from social and black market sources.
  – Contrasts with research on youth use of alcohol and tobacco research findings that youth use is higher where adult is easier (e.g., where there is a greater density of alcohol outlets)
  – Although perceiving easy access is influential on whether a student uses marijuana, other (unmeasured) factors determine whether a student will use marijuana or not.
Recommendations

• More research should be carried on the factors that influence student’s perceptions of the health risk of marijuana use, such as whether these perceptions are related to exposure to prevention programs or media campaigns.

• More research is needed into where and how youth obtain marijuana and how access could be limited in these contexts.

• More research, including qualitative research, is needed to identify school and peer group factors that influence youth marijuana use.
Limitations and Strengths

• Limitations:
  – CHKS data is self-report and not intended to be representative of all California students but of each district.
  – Compliance with city policies varies
    • E.g., does not always correspond with what may be found in actuality

• Strengths:
  – CHKS data is high quality and able to assess local trends in youth marijuana use.
  – Fills a need for empirical evidence to support policy approaches to prevent youth marijuana use.
  – Immediate relevance to regulations under development for both medical and recreational marijuana
Thank You!

Questions?