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Original article

## Examination of the Divergence in Trends for Adolescent Marijuana Use and Marijuana-Specific Risk Factors in Washington State


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## A B S T R A C T

**Purpose:** As marijuana laws have become more permissive, survey data on adolescents in the United States have shown an increase in marijuana-specific risk factors, particularly in the proportion of youth who do not perceive marijuana use as harmful. Prevalence of marijuana use among youth, however, has changed little. Using representative data from Washington State, which has legalized medical and nonmedical marijuana for adults, we examined two competing hypotheses to account for this divergence in population trends.

**Methods:** Data were from 2000 to 2014 biennial Washington State surveys of 10th-grade students. First, we assessed whether associations between marijuana use and marijuana-specific risk factors have weakened over time. Second, we examined whether decreases in alcohol and cigarette use can account for the lack of expected increase in marijuana use prevalence.

**Results:** Despite stability in marijuana use prevalence, there were increases in marijuana-specific risk factors of low perceived harm, youth favorable attitudes about use, and perceived community attitudes favorable to use. Associations between marijuana use and marijuana use predictors varied little across time; if anything, the positive association between low perceived harm and marijuana use grew stronger. Decreases in prevalence of alcohol and cigarette use largely accounted for stability in marijuana use during a period when marijuana risk factors increased.

**Conclusions:** Decreases in other types of substance use or in the underlying, common risk for substance use may have mitigated effects of increases in marijuana-specific risk factors.

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**IMPLICATIONS AND CONTRIBUTION**

In Washington State, individual-level associations between marijuana-specific risk factors and adolescent marijuana use have remained stable since 2000, despite recent population-level increases in some risk factors that have not been matched by increases in adolescent marijuana use. Decreases in prevalence of alcohol and cigarette use may account for this divergence.

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**Conflicts of Interest:** The authors have no conflicts of interest to declare.

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For most of the past 40 years, national trends in prevalence of adolescent marijuana use and perceived harmfulness of marijuana use have mirrored one another [1], which has made low perceived harm a target in a risk factor-based approach to prevention [2,3]. Recently, however, trends in perceived harm and marijuana use have diverged. The percentage of youth reporting that there is little harm from using marijuana increased steadily

and markedly since 2006; meanwhile, the prevalence of marijuana use increased slightly between 2006 and 2010, but changed little in the most recent waves of national data [1,4–7]. Other indicators of risk may have also increased in the context of liberalization of marijuana laws and increasing public approval of marijuana legalization. Other marijuana-specific risk factors include favorable attitudes about marijuana use, perception of community attitudes favorable to marijuana, and easy access to marijuana (e.g., [8–11]). National data on 15- to 17-year-olds indicate a decline in disapproval of marijuana use between 2009 and 2013 [11], while evidence regarding change in access and perception of community norms is mixed [1,5,12]. In this study, we examined trends in these risk indicators and adolescent substance use in Washington State.

Adolescent marijuana use in Washington State, although higher than the national average, has followed national trends, declining from the late 1990s to mid-2000s, increasing modestly until 2010, and then declining slightly through 2014 [13]. The Washington State data also show a large increase in low perceived harm of marijuana use during the past decade and a half [13]. Notably, Washington State legalized medical marijuana in 1998, with a loosely regulated medical marijuana market that expanded greatly after the federal justice department's 2009 Ogden memo, and legalized recreational marijuana in 2012 [14]. States allowing medical marijuana have, on average, higher prevalence of adult and adolescent marijuana use than states without medical marijuana [7,15,16], but research on the impact of medical marijuana laws on change in adolescent marijuana use has found small or no effects [7,17,18]. Some research indicates, however, that impact of marijuana laws depends on variation in those laws [19] and states where medical marijuana markets expanded rapidly after 2009 may have experienced particularly large increases in marijuana risk factors for adolescents [20,21].

The divergence in trends for low perceived harm and marijuana use raises the possibility that low perceived harm is no longer a strong risk factor for marijuana use and, more generally, calls into question the stability in relationships between risk factors and substance use. Weakening of marijuana-specific risk factors could be rooted in exposure to medical marijuana advertising [22] and acceptance of marijuana as a treatment for some medical conditions. This may have led to a decoupling wherein how youth answer questions about harm, their own or others' attitudes, or availability no longer strongly predicts use.

Although divergence in marijuana-specific risk factors and reported use has occurred at the population level, the individual-level association may remain strong [23,24]. An alternative explanation for divergence in trends is that concurrent changes in other factors counteracted increases in marijuana-specific risk factors. Candidates for these types of changes include decreases in adolescent alcohol and cigarette use in recent years [1,6]. Although some research has found evidence of substitution between marijuana and alcohol use among adult populations [21,25], adolescent marijuana, alcohol, and cigarette use have been positively associated with one another (e.g., [26,27]). The mechanisms underlying these associations may involve gateway processes [28] or complementary effects wherein one type of substance is used to enhance the effects of another [29]. The associations may also be rooted in a trait-like common liability or vulnerability to substance use [30,31]. In an analysis that includes multiple changing factors, population decreases in alcohol and cigarette use may account

for the stability in marijuana use in the presence of increases in marijuana-specific risk.

The current study used biennial statewide survey data from 10th-grade students in Washington State and examined these two hypotheses regarding the seemingly paradoxical stability in marijuana use during a time of increased marijuana-specific risk. First, we examined the stability of associations between marijuana-specific risk factors and marijuana use over the past 15 years, testing whether these associations have weakened. Second, we examined whether decreases in alcohol and cigarette use accounted for divergence in trends for marijuana-specific risk factors and marijuana use, testing the second hypothesis that countervailing changes in other factors offset increases in marijuana-specific risk.

## Methods

### *Data source and sample*

Data were from the Washington State Healthy Youth Survey [32] that is administered biennially to representative cross-sectional samples of 6th-, 8th-, 10th-, and 12th-grade students in Washington State schools. Participation in the surveys was voluntary and anonymous. Our study was exempt from human subjects review by the Washington State Institutional Review Board. We present results based on 10th-grade survey data from 2000 to 2014. (Results of analyses conducted on 12th-grade data are available in the [Online Supplement](#).) Public schools were randomly selected to administer surveys, with 60%–90% of selected high schools participating across years. Participation for students in those schools ranged from 46% to 67% across years. A range of 33–59 schools were represented in any given year, or a total of 269 school-year units.

Pencil-and-paper surveys were administered in classrooms in multiple forms. The analysis sample consisted of 30,365 students who completed forms that included questions on the marijuana-specific risk factors and who responded to the item on perceived harm of regular marijuana use. Year-specific samples ranged from 2,507 to 4,660. Overall, 48% of the analytic sample was male, with little variation across years. In 2000, the sample was 71% non-Hispanic white, 5% African-American, 10% Asian (including Pacific Islander), 3% Native American, 11% Hispanic, and 1% other (i.e., students choosing “other” ethnic category or endorsing multiple categories); in 2014, the composition was 57% non-Hispanic white, 5% African-American, 12% Asian, 2% Native American, 11% Hispanic, and 13% other. The racial/ethnic composition was representative of the 10th-grade public school population in Washington State [33].

### *Measures*

We dichotomized measures of substance use and risk to match the way these variables are commonly used when mapping national- and state-level trends [e.g., 1]. (Sensitivity analyses were conducted using the full range of response options on all the substance use and risk items. Results are available in the [Online Supplement](#).)

*Marijuana use.* Students were asked on how many days in the prior month they had used “marijuana or hashish (grass, hash, pot)” and were offered five response options ranging from “none” to “10 or more.” We created two measures of marijuana

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