Addictive Behaviors 74 (2017) 13–19

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Risk is still relevant: Time-varying associations between perceived risk and marijuana use among US 12th grade students from 1991 to 2016

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ARTICLE INFO

Keywords:
Marijuana
Perceived risk
Adolescent
Time-varying effect modeling

ABSTRACT

Background: Perceived risk of harm has long been a key preventive factor for adolescent marijuana use. However, in recent years, perceived risk has decreased markedly and marijuana use has increased only slightly, leading to new questions about their association. This study investigates the magnitude and stability of the US adolescent marijuana risk/use association from 1991 to 2016, overall and by gender and race/ethnicity.

Methods: Self-reported data on past 12-month marijuana use, perceived risk of regular marijuana use, gender, and race/ethnicity were obtained from 275,768 US 12th grade students participating in the nationally representative Monitoring the Future study. Time-varying effect modeling (TVEM) was used to examine the marijuana risk/use association over time.

Results: Both before and after controlling for gender and race/ethnicity, perceived risk was a strong protective factor against adolescent marijuana use. The magnitude of the great risk/use association strengthened for Hispanic students; remained generally stable over time for 12th graders overall, males, females, and White students; and weakened for Black students. The magnitude of the moderate risk/use association strengthened for 12th graders overall, males, females, White and Hispanic students, but did not continue to strengthen for Black students from 2005 onwards. In general, marijuana use prevalence decreased over time within all levels of perceived risk.

Conclusions: Perceived risk remains a strong protective factor for adolescent marijuana use, and the protective association for moderate risk (vs. no/slight risk) is actually increasing over time. Results suggest that accurate and credible information on the risks associated with marijuana use should remain a key component of prevention efforts.

1. Introduction

Significant academic and health risks associated with marijuana use have been recognized, including lower academic achievement and functioning (Brook, Stimmel, Zhang, & Brook, 2008), respiratory disease, injury and death, cognitive impairment, schizophrenia, and other psychoses (National Academies of Sciences, Engineering, and Medicine, 2017; Volkow, Baler, Compton, & Weiss, 2014). From 2004 to 2011, the rate of emergency department visits for adolescents aged 12–17 involving marijuana rose from 154 per 100,000 to 240.2 (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014a). In 2014, more adolescents aged 12–17 received treatment for marijuana use than all other substances combined, including alcohol (Han, Hedden, Lipari, Copello, & Kroutil, 2015). Given the documented health risks associated with marijuana use—particularly for adolescents—changes in the level of perceived risk associated with marijuana use may call for public health attention, as perceived risk historically has been associated with use behavior.

The degree to which individuals perceive they risk harming themselves by using marijuana is hypothesized to influence decisions to use or abstain. The risk/use association is grounded in the Health Belief Model, which posits that attitudes and beliefs significantly impact the likelihood of health-related behavior (Janz & Becker, 1984; Rosenstock, 1974). As early as 1981, nationally representative data from high school seniors indicated perceived risk of harm from regular marijuana use was strongly associated with actual use (Johnston, Bachman, & O'Malley, 1981). Perceived risk was shown to be a strong explanatory factor in observed national decreases in marijuana use from 1976 to 1986 (Bachman, Johnston, O'Malley, & Humphrey, 1988). Further, significant declines in perceived risk during the 1990s appeared to explain corresponding increases in marijuana use for US middle and high school students (Bachman, Johnston, & O'Malley, 1998). Perceived risk is now recognized as an important factor for preventing adolescent marijuana use (SAMHSA, 2014b; Stephens et al.,

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http://dx.doi.org/10.1016/j.addbeh.2017.05.026
Received 10 March 2017; Received in revised form 17 May 2017; Accepted 22 May 2017
Available online 23 May 2017

2009).

Recent changes in descriptive trends of perceived risk and use indicate they no longer track as mirror-images of each other as they did in the past. The National Survey on Drug Use and Health (NSDUH) and the Monitoring the Future (MTF) study reported that adolescents age 12–17 who perceived great risk of harm from marijuana use remained significantly less likely to use marijuana than those perceiving less or no risk, but the prevalence of perceiving great risk had decreased sharply while use prevalence increased only minimally (Miech, Johnston, O'Malley, Bachman, & Schulenberg, 2016; SAMHSA, 2013a). NSDUH data showed perceived great risk from monthly marijuana use decreased from 55% to 45% from 2007 to 2011, while monthly marijuana use prevalence increased only 1% (SAMHSA, 2013a). MTF data showed that among 12th grade students, the percentage perceiving great risk in regular marijuana use decreased from 58% to 32% from 2006 to 2016, while past 12-month use increased only 3 percentage points (Miech et al., 2016). Similar results have been found for state-level surveys (Hughes, Lipari, & Williams, 2015), including studies in states that have legalized adult recreational marijuana use (Colorado Department of Public Health and Environment [CDPHE], n.d.; Alcohol and Drug Abuse Institute [ADAI], 2015). Overall, these findings raise the possibility that perceived risk may have become a weaker protective factor for adolescent marijuana use, because trends for the two factors have become increasingly disconnected in recent years.

One possible explanation of the disconnect between risk and use trends may involve weakening of the of statistical association between perceiving risk in using marijuana and decisions to use. It may be that both marijuana users and non-users are coming to agree with the perspective that marijuana use does not involve risk for most individuals (e.g., Sullum, 2016). If true, this would lead to an attenuation over time of the statistical association between perceived risk and use that, if occurring among the adolescent population overall or at least the majority of key demographic subgroups, would be observed as a disconnect between risk and use descriptive trends. If the strength of the risk/use association has weakened, allocation of limited prevention resources to addressing deficiencies in knowledge regarding marijuana use risk would lower in priority.

An alternative possibility is that apparent disconnect based on descriptive trends does not equate with weakening of the statistical association between risk and use. Fleming and colleagues used data from Washington state to examine stability over time in the strength of cross-sectional marijuana risk/use associations among 10th grade students from 2000 to 2014 (Fleming, Guttmannova, Cambron, Rhew, & Oesterle, 2016). Logistic regression models using year-specific interaction terms indicated the association between perceiving no/slight risk (vs. moderate/great risk) and use had actually strengthened somewhat over time, controlling for gender and race/ethnicity (Fleming et al., 2016). If the risk/use association is not weakening over time, there should be continued and possibly increased allocation of prevention resources to addressing deficiencies in knowledge regarding marijuana use risks given the overall decreasing prevalence of perceived risk.

There are well-established gender and racial/ethnic differences in marijuana perceptions and use. Compared with boys, girls have had higher perceived risk (Danesco, Kingery, & Coggeshall, 1999; Pacek, Mauro, & Martins, 2015; SAMHSA, 2013a) and lower use prevalence (Miech et al., 2016; SAMHSA, 2014c). The association magnitude between marijuana perceptions and use has been stronger for White adolescents than Hispanic or African American adolescents (Wu et al., 2015). The degree to which marijuana risk/use association strength may be weakening or remaining strong over time may vary across gender or racial/ethnic groups. Knowledge of population subgroup differences in either the stability or change in marijuana risk/use association strength could help inform targeted prevention efforts.

1.1. The current study

The current study aims to contribute to the marijuana use epidemiology literature by using national data to statistically model adolescent marijuana risk/use association strength over time at the national level for the adolescent population overall and gender and racial/ethnic subgroups. Such analyses optimally would be conducted using methods specifically designed to examine change over time in association strength. Analyses optimally also would aim to provide a detailed examination of the strength of risk/use association at different levels of perceived risk, as little research has focused on the strength of association between different levels of perceived risk and use. Most research has used only a simple dichotomous categorization of perceiving great risk versus all other risk perception levels; exceptions to this include two studies that have examined perceiving moderate/great harm versus no/slight harm (Brooks-Russell et al., 2015; Fleming et al., 2016).

The current study used time-varying effect modeling (TVEM) to examine time-varying cross-sectional associations from 1991 to 2016 between various levels of perceived risk and use of marijuana among US 12th grade students. Two research aims were directed by two competing research hypotheses:

H1. The strength of statistical associations between perceiving (a) great risk or (b) moderate risk (vs. no/slight risk) and past 12-month marijuana use has weakened over time.

H2. The strength of statistical associations between perceiving (a) great risk or (b) moderate risk (vs. no/slight risk) and past 12-month marijuana use has remained strongly significant.

Research aims included statically modeling risk/use association strength for the overall student population (Aim 1), as well as separately for gender and racial/ethnic subgroups (Aim 2).

2. Methods

2.1. Participants

Analyses used data from the Monitoring the Future (MTF) study; detailed methodology is available elsewhere (Bachman, Johnston, O'Malley, Schulenberg, & Miech, 2015; Miech et al., 2016). MTF annually surveys nationally representative cross-sectional samples of approximately 15,000 12th grade students in approximately 130 schools in the coterminous US. Informed consent is obtained; a University of Michigan Institutional Review Board has approved the MTF study. Surveys were administered in classrooms by study personnel; students self-completed questionnaires during a normal class period. From 1991 to 2016, student response rates averaged 83%. Absenteeism was the primary reason for missing data; < 1% of students refused participation. Perceived risk of marijuana use was asked on 5 of the 6 randomly distributed 12th grade questionnaire forms. Between 1991 and 2016, a total of 319,036 students responded to the relevant forms. Of these, 275,768 (86.4%) provided valid data for all measures included in this analysis. Cases retained for analysis were more likely than those removed due to missing data to perceive great risk (57.5% vs. 46.3%; $p < 0.001$), to report using marijuana (34.2% vs. 29.5%; $p < 0.001$), and to be female (52.0% vs. 45.7%; $p < 0.001$) and White (66.9% vs. 49.8%; $p < 0.001$).

2.2. Measures

Respondents were asked on how many occasions (if any) they had used marijuana (or hashish) during the past 12 months. Responses (on a 7-point scale ranging from 1 = 0 occasions to 7 = 40 + occasions) were dichotomized into any use versus no use. Perceived risk was asked as follows: “How much do you think people risk harming themselves