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### Authors

Lipperman-Kreda, Sharon

Grube, Joel W

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**Impacts of Marijuana Commercialization on Adolescents' Marijuana Beliefs, Use, and Co-Use with other Substances**

Sharon Lipperman-Kreda Ph.D.<sup>1</sup>

Joel W. Grube, Ph.D.<sup>1</sup>

<sup>1</sup> Prevention Research Center, Pacific Institute for Research and Evaluation, 180 Grand Avenue, Suite 1200, Oakland, CA 94612

In the US, as of March 2018, medical use of marijuana is legal in 28 states and the District of Columbia and recreational use is legal in 8 states and the District of Columbia [1, 2]. The liberalization of marijuana laws raises public health concerns, particularly about possible effects on adolescents' marijuana use and problems. Despite potential risks [3-11], the 2016 Monitoring the Future survey shows that 36% of 12<sup>th</sup> graders and 24% of 10<sup>th</sup> graders reported past year marijuana use and 23% and 14%, respectively, reported past 30 day use [12]. About 81% of 12<sup>th</sup> graders and 64% of 10<sup>th</sup> graders reported that marijuana is “fairly easy” or “very easy” to get. Only 31% of 12<sup>th</sup> graders and 44% of 10<sup>th</sup> graders perceived “great risk” in regular marijuana use.

Commercialization of cannabis, including marijuana, concentrates, and edibles, may affect adolescents' use directly by increasing availability or indirectly by promoting beliefs that its use is safe and normative [13-16]. Although legal sales of recreational marijuana are restricted to adults, enforcement compliance checks indicate that between 11%-23% of recreational outlets may sell to minors [17, 18]. In addition, commercialization may increase the

availability of marijuana through diversion, increase exposure to aggressive marketing tactics by the emerging cannabis industry, or increase exposure to others who use or illicitly sell marijuana. Legalization of cultivation for personal use raises additional concerns about access and exposure. Co-use of marijuana with other drugs may be exacerbated by legalization [19]. Although some studies have found positive associations between densities of medical marijuana dispensaries and marijuana use among adults [20, 21], very little is known about the potential influence of adolescents' exposure to marijuana dispensaries, recreational outlets, and marketing or the mechanisms through which such exposure may affect their marijuana use. Studies showing associations between adolescents' exposure to alcohol and tobacco outlets and use of those substances [22-33], suggest the importance of investigating exposure to retail access and marketing of marijuana.

The article by Shi et al., [34] makes a timely contribution to this field of research by investigating associations of proximity and density of medical marijuana dispensaries, price of medical marijuana products, and variety of products sold in school neighborhoods with adolescents' marijuana use and susceptibility. Results showed no associations between adolescents' current use or susceptibility to use marijuana and proximity or density of medical marijuana dispensaries around schools, price, and product variety. Focusing on exposure around school neighborhoods, this study used traditional measures of proximity and density of outlets around schools. Such measures are often used in studies to assess influences of exposure to alcohol and tobacco outlets on use of those substances. However, research shows that the locations in which young people spend their time are varied and geographically dispersed, and not captured by geographical boundaries such as school or home neighborhoods [35, 36]. Activity spaces include all locations and the routes the individuals experience as a result of their

daily activities [37-39]. Recent studies have found that adolescents' activity spaces provide a more accurate measure of alcohol and tobacco outlet exposures than do traditional measures [22, 31]. Future research should consider marijuana retail availability in the broader environments where adolescents spend their time.

Moreover, the cannabis market is evolving in ways that make it different than the tobacco and alcohol markets. In addition to marijuana, myriad cannabis products (e.g., edibles, concentrates, infusions, tinctures, lotions, butters) are available and heavily marketed. These products can be smoked, eaten, vaped, or used topically. Many of these products are easily transportable and readily concealed or disguised. Many of them can be used covertly (e.g., candies), possibly making use by adolescents less risky than is the case for most alcohol or tobacco products. As noted by Shi et al., [34] future research should consider the range of cannabis products to more accurately assess the effects of marijuana commercialization on adolescents' marijuana beliefs and use. In addition, unlike alcohol and tobacco, there remains a substantial illegal market. Given tax policies and the resulting price differentials, the underground market may remain a preferred source of marijuana for adolescents. The situation is further complicated by provisions allowing individuals to grow marijuana for personal use, possibly providing access for adolescents directly from family members, friends, and acquaintances who grow it or by providing increased opportunities to steal it. Although the legal market may not be a primary source of marijuana for adolescents, it nonetheless may have an influence by increasing open consumption in public and the home, by normalizing marijuana use, and by increasing exposure to marketing. Importantly, some adolescents (e.g., impulsive or marginalized youth) may be more susceptible to exposure to marijuana outlets in their daily lives, and therefore at greater risk for marijuana use, susceptibility and problems. The lack of

associations between the geography of marijuana dispensaries and marijuana use by adolescents, observed by Shi et al., [34] suggests that the mechanisms by which retail marijuana availability may influence adolescents' use and problems may be complex.

As the national landscape regarding marijuana legalization changes in the US, more research is needed to understand adolescents' exposures to marijuana commercialization and the mechanisms by which exposures to marijuana dispensaries, recreational outlets, and marketing may affect marijuana use and beliefs. Such research is important to guide policies and prevention efforts to reduce the potential negative effects of marijuana commercialization.

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### **Conflicts of Interest**

None.

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