Revisiting the Gateway Hypothesis by considering the effect of age-of-first use on subsequent illicit drug use

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Abstract

The *Gateway Hypothesis*, originally formulated in 1975 by Denise Kandel, claims that drug use evolves in stages. It starts with either tobacco or alcohol use, progresses to the use of the other, then to marijuana, and then to other more dangerous illicit substances. Use of a drug in one stage is a required precursor for, but not a determinant of, use in subsequent stages. While debate persists regarding this theory, it has been recognized and demonstrated in many studies since its conception. This study builds upon this work by showing the relationship between the age of first use (AFU) of early stage quasi-licit drugs (tobacco, alcohol, and marijuana) and the likelihood of use of illicit drugs such as cocaine or heroin. Machine learning techniques, specifically decision tree and linear regression analyses, are applied to 2016-2019 data from the National Survey of Drug Use and Health to model the relationship between the determinant features (AFU of tobacco, alcohol, and marijuana) and the dependent variable – any lifetime use of other illicit drugs. Both models proved to be very accurate, with test set area under the receiver operating curve values of 0.84. The decision tree model performed best and accurately predicted 83% of illicit drug users and 73% of non-users. The decision tree model found that marijuana AFU was by far the most important predictive feature (importance score of 0.93), and that 32% of illicit drug users first

used marijuana at an age of less than 16.4 years. In the linear regression model, the coefficients of AFU were 3.87 for tobacco, 7.60 for alcohol, and 36.65 for marijuana. The coefficient for the combination of marijuana and tobacco AFUs was significantly higher at 114.83. These findings make clear the risks associated with early marijuana use and call for further study of the issue in order to develop policies to reduce illicit drug use among minors in the face of ongoing marijuana legalization.

Audience Learning Points

- The study addresses a gap in Gateway Hypothesis literature by adding an analysis of AFU data and its effect on illicit drug use.
- Early age marijuana use greatly increases the ability to identify illicit drug use.
- Researchers can use these findings for more specific studies of early age marijuana users and their subsequent behavior.
- Policymakers can use this study to justify regulations on packaging of legal marijuana products, restrictions on access to marijuana, and penalties for providers of marijuana to underage users.

Biography of Presenting Author

Matthew Beattie is currently an Adjunct Professor of Data Science at the University of Oklahoma (OU). His research has focused on the application of machine learning to social challenges, including addiction, disease propagation, and homelessness. He is a member of the Data Science and Analytics Institute and the Data Institute for Societal Challenges, both at OU. His education includes Master's degrees from OU and the North Carolina State University, and a Bachelor of Science from Duke University. Dr. Beattie is a U.S. Army Veteran and has a career in industry including executive positions in multiple companies including AT&T and Crown Castle.

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Photo of Presenting Author

Fig. 1 Matthew J. Beattie, PhD