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The end of convergence in developmental patterns of frequent marijuana use from ages 18 to 30: An analysis of cohort change from 1976–2016

Yvonne M. Terry-McElrath^{a,*}, Megan E. Patrick^b, Patrick M. O'Malley^a, Lloyd D. Johnston^a^a Institute for Social Research, University of Michigan, PO Box 1248, Ann Arbor, MI 48106-1248, USA^b Institute for Translational Research in Children's Mental Health, Institute of Child Development, University of Minnesota, 1100 Washington Ave S., Suite 101, Minneapolis, MN 55414, USA

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ABSTRACT

Background: This study examines the extent to which the developmental pattern of frequent marijuana use prevalence from ages 18 to 30 (overall and by gender) has varied across historical time (cohort groups) using data from a national sample of US young adults.

Methods: Self-reported data on frequent marijuana use (use on 20+ occasions in the past 30 days) from modal ages 18 to 30 were obtained from 58,059 individuals from 29 sequential cohorts (graduating high school classes of 1976–2004) participating in the Monitoring the Future study. Time-varying effect modeling was used to model cohort group differences in developmental patterns of frequent use overall and by gender.

Results: Developmental patterns of frequent marijuana use prevalence varied meaningfully across cohort groups. Frequent use at age 18 differed significantly across cohort groups as expected based on national data. Among earlier cohort groups (reaching age 30 during 1987–2008), developmental patterns converged by age 30 to relatively low frequent marijuana use prevalence. In contrast, among cohort groups reaching age 30 during 2008–2016, frequent marijuana use at age 30 was significantly higher than all previous cohort groups. Observed cohort differences did not vary significantly by gender.

Conclusions: Cross-cohort convergence in developmental patterns of frequent marijuana use prevalence by age 30 was not observed among recent cohort groups, among whom age 30 frequent marijuana use prevalence was at the highest levels observed since the study began. Higher frequent marijuana use prevalence in late young adulthood has meaningful health risk and service provision implications.

1. Introduction

Previous research has shown that marijuana use prevalence typically increases from late adolescence through the early years of young adulthood (roughly ages 21/22) and then decreases thereafter (Bachman et al., 1997; Substance Abuse and Mental Health Services Administration, 2017; Schulenberg et al., 2005, 2017; Terry-McElrath and O'Malley, 2011). Trends in age-specific marijuana use prevalence clearly indicate marked changes across historical time (Centers for Disease Control and Prevention [CDC], 2015; Johnson et al., 2015; Miech et al., 2017; Substance Abuse and Mental Health Services Administration, 2017; Schulenberg et al., 2017), but few studies have examined the extent to which the typical developmental pattern of marijuana use prevalence across age changes over historical time. One study investigated historical change in the developmental pattern of

marijuana use from ages 18 through 22 using data from 1976 to 2004 (Jager et al., 2013) and found evidence of a modest increase in the growth rate for past 30-day marijuana use frequency from ages 18 through 22 across cohorts of 12th graders followed into young adulthood. However, the study did not examine variation in the developmental pattern of marijuana use after age 22.

Possible historical change in the developmental pattern of higher-frequency marijuana use is particularly important. Those who use marijuana frequently are at heightened risk for many negative outcomes including addiction (Volkow et al., 2014), cognitive impairment (Gordon et al., 2013; Becker et al., 2014; Whitlow et al., 2004), some cancers (Gordon et al., 2013), and other health issues (Hézone et al., 2008; Ishida et al., 2008). Chronic higher-frequency marijuana use extending into the 30s or beyond is associated with particularly poor outcomes including increased anxiety symptoms, crime involvement,

* Corresponding author.

E-mail addresses: yterry@umich.edu (Y.M. Terry-McElrath), mpatrick@umn.edu (M.E. Patrick), pomalley@umich.edu (P.M. O'Malley), lloydj@umich.edu (L.D. Johnston).

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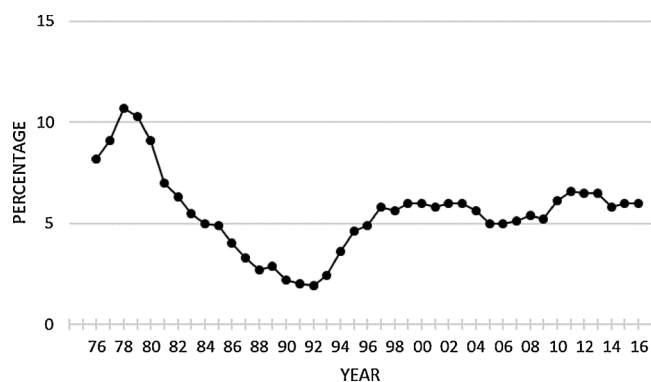


Fig. 1. Historical trends in prevalence of past 30-day frequent marijuana use in grade 12.

Note: Frequent use defined as use on 20 or more occasions in the last 30 days. Source: The Monitoring the Future Study, the University of Michigan (Miech et al., 2017).

sexual risk behaviors, and abuse/dependence symptoms for marijuana, alcohol, and tobacco by age 33 (Epstein et al., 2015), lower verbal memory measured during the mid-40s to mid-50s (Auer et al., 2015), and higher likelihood of past 30-day cognitive health problems, past 12-month psychological visits, and lifetime psychiatric, drug, and alcohol problems by age 50 (Terry-McElrath et al., 2017). Thus, a developmental pattern that is consistent across historical time reflecting decreasing higher-frequency marijuana use from the mid-20s onward is desirable from a public health viewpoint.

National data (Miech et al., 2017) show that use of marijuana on 20 or more occasions in the past 30 days (hereafter referred to as frequent marijuana use) among high school seniors reached a high of 10.7% in 1978, decreased over time to 1.9% in 1992, increased to 5.8% by 1997, and then remained between 5.0% and 6.6% from 1998 through 2016 (see Fig. 1). To the extent that the developmental pattern of frequent marijuana use from ages 18 through 30 has remained generally stable in form across cohorts (i.e., increasing from late adolescence through roughly ages 21/22 and then decreasing thereafter), one would expect frequent marijuana use to remain highest through age 30 among individuals in high school cohorts of the late 1970s and early 1980s (cohorts with the highest age 18 frequent marijuana use) and to remain lowest for individuals in high school cohorts of the early 1990s (cohorts with the lowest age 18 frequent marijuana use). If, however, the developmental pattern has varied significantly across cohorts, the prevalence of frequent marijuana use by age 30 may not be accurately estimated based on use at age 18. Recent data show that frequent marijuana use among young adults is at historically high prevalence levels, including among those aged 27–30 (Schulenberg et al., 2017). Such historically high prevalence levels may indicate meaningful changes in the developmental pattern of frequent marijuana use across age.

There are recognized gender differences in marijuana use throughout adolescence and young adulthood. Marijuana use prevalence (including frequent use prevalence) is typically significantly higher for men than women from late adolescence throughout adulthood (Chen and Jacobson, 2012; Johnston et al., 2017, 2018; Miech et al., 2017; Substance Abuse and Mental Health Services Administration, 2016). Men increase marijuana use from mid- to late adolescence at a faster rate than women (Kuhn, 2015) and reach peak use at slightly later ages than women (Chen and Jacobson, 2012). Jager et al. (2013) found an increase over time in the growth rate for past 30-day marijuana use frequency for both men and women, but potential gender differences in the historical stability of the developmental pattern of marijuana use (particularly frequent marijuana use) from ages 18 through 30 have not been examined. The observed historically high prevalence levels of frequent marijuana use among those aged 27–30

have been found for both men and women (Schulenberg et al., 2017).

The current study adds to the marijuana use epidemiology literature by using longitudinal data from 29 national cohorts of high school seniors (classes of 1976–2004; data collected from 1976 to 2016) to examine the extent to which both overall and gender-specific developmental patterns of frequent marijuana use from ages 18 through 30 have varied across cohorts.

2. Methods

2.1. Sample

Analyses used data from the Monitoring the Future (MTF) study; detailed methodology is available elsewhere (Bachman et al., 2015; Miech et al., 2017; Schulenberg et al., 2017). Briefly, US nationally-representative samples of approximately 15,000 12th graders (modal age 18) from about 130 public and private schools in the contiguous 48 states have been surveyed annually since 1975. Students complete self-administered surveys, typically during a normal class period. Since 1976, a sub-sample of about 2400 12th graders has been selected from each annual sample for longitudinal follow-up (with drug users sampled at a higher rate). A random half of the follow-up sample receives a series of biennial follow-ups beginning one year after their senior year (modal age 19); the other half receives a series of biennial follow-ups beginning two years after their senior year (modal age 20). Mailed questionnaires are used to collect data at six follow-up time points: modal ages 19/20, 21/22, 23/24, 25/26, 27/28, and 29/30. The resulting data include responses at all modal ages from 18 through 30 (although individual respondents provide data at a maximum of 7 modal ages). A University of Michigan Institutional Review Board approved the study.

Analysis was limited to cohorts who had the opportunity to complete all baseline and follow-up surveys through age 29/30 as of the date of analysis. The decision to focus on ages 18 through 30 was based on (a) the importance of the developmental period recognized as young adulthood (Institute of Medicine, National Research Council, 2015), (b) the fact that historically high prevalence levels for frequent marijuana use have recently been observed across the ages of 19–22, 23–26, and 27–30 (Schulenberg et al., 2017), and (c) expansion past the age of 30 would reduce the number of cohorts that could be included in analysis. Thus, the analytic sample was limited to 12th grade cohorts from 1976 to 2004 (age 29/30 data were collected during 2001–2016). A total of 70,843 individuals were selected for follow-up participation from relevant cohorts. Cases were limited to 58,076 respondents (82.0% of the original sample) who participated in baseline data collection and at least one of the six follow-up data collection efforts. Of these respondents, 58,059 (99.97%) provided data on frequent marijuana use on at least one occasion. The mean number of responses regarding frequent marijuana use per respondent in the resulting analytic dataset was 5.3 (range of 1–7). Males constituted 46.4% of respondents. Attrition adjustments are discussed below.

2.2. Measures

On each survey, respondents were asked, “On how many occasions (if any) have you used marijuana or hashish during the last 30 days?” (0, 1–2, 3–5, 6–9, 10–19, 20–39, and 40 or more occasions). In sensitivity analyses, two dichotomies were examined in regards to the study research questions: use on 20+ occasions versus use on 40+ occasions in the past 30 days. Results were not substantively different. For the current study, individuals who reported using on 20 or more occasions in the past 30 days were classified as frequent users. Gender was coded as male or female. Cohort (indicating year of baseline survey) was coded into seven non-overlapping groups sharing common patterns of change over historical time in age 18 frequent marijuana use prevalence described in the Introduction and shown in Fig. 1. A total of

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