



Full length article

## Trends in cannabis use disorder by cigarette smoking status in the United States, 2002–2016



Andrea H. Weinberger<sup>a,b</sup>, Lauren R. Pacek<sup>c</sup>, Melanie M. Wall<sup>d,e,f</sup>, Michael J. Zvolensky<sup>g,h</sup>, Jan Copeland<sup>i</sup>, Sandro Galea<sup>j</sup>, Shadi Nahvi<sup>k</sup>, Scott J. Moeller<sup>l,m</sup>, Deborah S. Hasin<sup>d,e,n</sup>, Renee D. Goodwin<sup>n,o,p,\*</sup>

<sup>a</sup> Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY, USA

<sup>b</sup> Department of Epidemiology & Population Health, Yeshiva University Albert Einstein College of Medicine, Bronx, NY, USA

<sup>c</sup> Department of Psychiatry and Behavioral Sciences, Duke University School of Medicine, Durham, NC 27705, USA

<sup>d</sup> Department of Psychiatry, College of Physicians and Surgeons, Columbia University, New York, NY, USA

<sup>e</sup> New York State Psychiatric Institute, New York, NY, USA

<sup>f</sup> Department of Biostatistics, Mailman School of Public Health, Columbia University, New York, NY, USA

<sup>g</sup> Department of Psychology, University of Houston, Houston, TX, USA

<sup>h</sup> Department of Behavioral Sciences, University of Texas MD Anderson Cancer Center, Houston, TX, USA

<sup>i</sup> Department of Medicine, University of New South Wales, Sydney, New South Wales 2052, Australia

<sup>j</sup> School of Public Health, Boston University, Boston, MA, USA

<sup>k</sup> Departments of Medicine and Psychiatry & Behavioral Sciences, Albert Einstein College of Medicine/Montefiore Medical Center, Bronx, NY, USA

<sup>l</sup> Departments of Psychiatry and Neuroscience, Icahn School of Medicine at Mount Sinai, New York, NY, USA

<sup>m</sup> Department of Psychiatry, Stony Brook University, Stony Brook, NY, USA

<sup>n</sup> Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA

<sup>o</sup> Institute for Implementation Science and Population Health, CUNY School of Public Health and Health Policy, New York, NY, USA

<sup>p</sup> Department of Epidemiology and Biostatistics, CUNY School of Public Health, New York, NY, USA

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### ABSTRACT

**Background:** Cannabis use is on the rise in the United States (US) and is disproportionately common among cigarette smokers. Cannabis use disorder (CUD) occurs among a small subset of cannabis users and may impact cigarette use. The objective of this study was to estimate trends in the prevalence of CUD among daily, non-daily, former, and never cigarette smokers from 2002 to 2016.

**Methods:** Data were drawn from cross-sectional, nationally representative samples of individuals ages 12 and older in the US that were collected annually. The prevalence of past 12-month CUD was estimated each year from 2002 to 2016 among daily, non-daily, former, and never cigarette smokers (total analytic N = 837,326). **Results:** Overall, the prevalence of CUD decreased from 2002 to 2016. Yet, trends differed by cigarette smoking status. Adjusting for demographics, the prevalence of CUD increased significantly among non-daily smokers (aOR = 1.02; 95% CI = 1.01–1.03) from 2002 to 2016 and did not change among daily, former, or never smokers. CUD was significantly more common among non-daily (4.32%) and daily cigarette smokers (2.92%) compared with former (0.99%) and never smokers (1.11%) in 2016. Approximately one in five (18.11%–22.87%) youth ages 12–17 who smoke cigarettes met criteria for CUD in 2016, compared with approximately 2% of non-smoking youth.

**Conclusions:** Despite downward trends in CUD observed at the general population level, the prevalence of CUD significantly increased among non-daily cigarette smokers from 2002 to 2016. In the US, CUD remains significantly higher among cigarette smokers relative to non-cigarette smokers.

\* Corresponding author at: Department of Epidemiology and Biostatistics, Graduate School of Public Health and Health Policy, The City University of New York, 55 West 125<sup>th</sup> St, New York, NY, 10027, USA.

E-mail addresses: [andrea.weinberger@einstein.yu.edu](mailto:andrea.weinberger@einstein.yu.edu) (A.H. Weinberger), [lauren.pacek@duke.edu](mailto:lauren.pacek@duke.edu) (L.R. Pacek), [mmw2177@cumc.columbia.edu](mailto:mmw2177@cumc.columbia.edu) (M.M. Wall), [mjzvolensky@central.uh.edu](mailto:mjzvolensky@central.uh.edu) (M.J. Zvolensky), [j.copeland@unsw.edu.au](mailto:j.copeland@unsw.edu.au) (J. Copeland), [sgalea@bu.edu](mailto:sgalea@bu.edu) (S. Galea), [snahvi@montefiore.org](mailto:snahvi@montefiore.org) (S. Nahvi), [scott.moeller@stonybrookmedicine.edu](mailto:scott.moeller@stonybrookmedicine.edu) (S.J. Moeller), [dsh2@columbia.edu](mailto:dsh2@columbia.edu) (D.S. Hasin), [renee.goodwin@sph.cuny.edu](mailto:renee.goodwin@sph.cuny.edu) (R.D. Goodwin).

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## 1. Introduction

Cannabis is used by more than 147 million people around the world and is the most commonly used drug that is labeled “illicit” by the World Health Organization (World Health Organization (WHO), 2017). Cannabis is in a unique situation among drugs as legalization of Cannabis use for medicinal and recreational purposes is spreading across states in the United States (US; Maxwell and Mendelson, 2016) and other countries (Room et al., 2010). The use of Cannabis has been increasing in the US in recent years (Azofeifa et al., 2016; Hasin et al., 2015, 2017) and perceptions of risk of Cannabis use are decreasing (Azofeifa et al., 2016; Compton et al., 2016; Johnston et al., 2016; Pacek et al., 2015). A study of adolescents in 38 North American and European countries found that Cannabis “liberalization” measures (e.g., reduced legal consequences, legalization) were associated with increased Cannabis use (Shi et al., 2015). These changes in the use and risk perceptions related to Cannabis raise concerns about whether the escalation in Cannabis use may also lead to an increase in associated problems, such as Cannabis use disorder (CUD).

CUD occurs among a subset of Cannabis users and is associated with substantial impairment and increased risk of other substance use, mental health, and psychosocial problems (Foster et al., 2017; Hall, 2015). In the US population, the 12-month CUD prevalence is estimated at almost 3%, which represents approximately 7.5 million persons (Hasin et al., 2015). Over the last several years, a number of studies have reported that the prevalence of CUD has increased over time in the US general population (Hasin et al., 2015), although other studies have reported either a decline in CUD among Cannabis users or no significant change over time (Compton et al., 2016; Grucza et al., 2016).

Cannabis use and cigarette use tend to co-occur (Schauer et al., 2015). Recent findings suggest that the majority of Cannabis use occurs among cigarette smokers relative to non-cigarette-smokers (Goodwin et al., 2018). Given that Cannabis use appears disproportionately common among cigarette smokers (Goodwin et al., 2018), greater health risks are associated with co-use of both cigarettes and Cannabis (e.g., psychosocial problems, increased toxicant exposure, Peters et al., 2012; Meier and Hatsukami, 2016), and there is the potential for increased vulnerability of cigarette smoking among people with substance use disorders in general (Lewinsohn et al., 1999; Palmer et al., 2009), people who smoke cigarettes may also be at increased risk for problematic Cannabis use, including CUDs. Since Cannabis use is disproportionately common among cigarette smokers, and daily Cannabis use occurs primarily among cigarette smokers (Goodwin et al., 2018), it is conceivable that trends in CUD over time may differ by cigarette smoking status (Schauer et al., 2017). Data suggesting that Cannabis use and CUDs are barriers to quitting cigarette smoking among current cigarette users and to sustained abstinence among former cigarette smokers (Weinberger et al., 2018; Weinberger et al., 2013) indicate the importance of understanding whether and to what degree the prevalence of CUD may be increasing in cigarette smokers over time. No prior investigation has compared the recent prevalence of CUDs by cigarette smoking status or examined whether changes in CUD prevalence differed over time by cigarette smoking status.

The goal of the current study was to examine trends in the prevalence of CUD by cigarette smoking status over the past decade using data from representative samples of US persons ages 12 and older. The first aim of the study was to estimate the degree to which CUD is prevalent in 2016 among daily, non-daily, former, and never cigarette smokers in the US overall and to examine whether these relationships differ by gender, age, marital status, income, and race/ethnicity. The second aim was to estimate trends in the prevalence of CUD from 2002 to 2016 among daily, non-daily, former, and never cigarette smokers in the US, adjusting for demographics.

## 2. Material and methods

### 2.1. Study population

Data were obtained from the 2002–2016 National Survey on Drug Use and Health (NSDUH) public use data files, for a combined total sample size of 837,326 individuals. The NSDUH was sponsored by the Substance Abuse and Mental Health Services Administration (SAMHSA) and designed to provide estimates of the prevalence of extra-medical use of legal and illegal drugs in US community-based individuals age 12 and older. The survey employed a 50-state design with an independent multistage area probability sample for each of the 50 states and the District of Columbia. Response rates for completed surveys during the aforementioned years ranged from 73%–79%.

Informed consent was obtained before the start of every interview. Participants were given a description of the study, read a statement describing the confidentiality of any information provided by participants, and assured that participation in the study was voluntary. Surveys were administered by computer-assisted personal interviewing (CAPI) conducted by an interviewer and audio computer-assisted self-interviewing (ACASI). Use of ACASI was designed to provide respondents with a private and confidential means of responding to questions, and to increase honest reporting of drug use and other sensitive behaviors. Respondents were offered US \$30 for participation. The analyses were based on de-identified publicly available data exempt from Institutional Review Board review.

Sampling weights for the NSDUH were computed to control for unit-level and individual-level non-response and were adjusted to ensure consistency with population estimates obtained from the US Census Bureau. In order to use the 15 years of combined data, a new weight was created aggregating the 15 datasets by dividing the original weight by the number of data sets combined. Further descriptions of the sampling methods and survey techniques for the NSDUH are found elsewhere (Center for Behavioral Health Statistics and Quality, 2016).

### 2.2. Measures

#### 2.2.1. Sociodemographic variables

Sociodemographic variables for this study included gender (male, female), age (12–17 years old, 18–25 years old,  $\geq 26$  years old), marital status (married, widowed/divorced/separated, never married), total annual family income ( $< \$20,000$ ,  $\$20,000$ – $\$74,999$ ,  $\geq \$75,000$ ), and race/ethnicity [[non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Other (i.e., Native American/Alaska Native; Native Hawaiian/Other Pacific Islander; Asian; more than one race)].

#### 2.2.2. Cigarette smoking variables

Current cigarette smoking status was assessed using the following questions: (1) “Have you ever smoked part or all of a cigarette?” (2) “Have you smoked at least 100 cigarettes in your entire life?”; and (3) “During the past 30 days, have you smoked part or all of a cigarette?” Individuals who reported smoking at least 100 cigarettes in their lifetime and at least 1 cigarette within the past 30 days were classified as current cigarette smokers. Current cigarette smokers were then subdivided based on frequency of smoking using the following question: “During the past 30 days, that is, since [DATEFILL], on how many days did you smoke part or all of a cigarette?” Those who reported smoking 1–29 days of the past 30 days were classified as current non-daily cigarette smokers and those who reported smoking all 30 of the past 30 days were classified as current daily cigarette smokers. Persons who had smoked at least 100 cigarettes in their lifetime but none in the past 30 days were classified as former cigarette smokers. Individuals who had never smoked part or all of a cigarette or smoked fewer than 100 cigarettes in their lifetime were classified as never smokers. Similar approaches have been utilized in prior research (Goodwin et al., 2018; Pacek et al., 2014).

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