Drug and Alcohol Dependence 182 (2018) 103–111

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

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

Full length article

Nonmedical prescription opioids and pathways of drug involvement in the US: Generational differences

Melanie Wall[a,b,c,d], Keely Cheslack-Postava[b], Mei-Chen Hu[b], Tianshu Feng[d], Pamela Griesler[b,c], Denise B. Kandel[b,c,e,*]

[a] Department of Biostatistics, Mailman School of Public Health, Columbia University, New York, NY 10032, USA
[b] Department of Psychiatry, Columbia University, New York, NY 10032, USA
[c] New York State Psychiatric Institute, New York, NY 10032, USA
[d] Research Foundation for Mental Hygiene, New York, NY 10032, USA
[e] Department of Sociomedical Sciences, Mailman School of Public Health, Columbia University, New York, NY 10032, USA

ARTICLE INFO

Keywords:
Drug initiation sequences
Nonmedical prescription opioids
Heroin
Cocaine
Generations

ABSTRACT

Background: This study sought to specify (1) the position of nonmedical prescription opioids (NMPO) in drug initiation sequences among Millennials (1979–96), Generation X (1964–79), and Baby Boomers (1949–64) and (2) gender and racial/ethnic differences in sequences among Millennials.

Methods: Data are from the 2013–2014 National Surveys on Drug Use and Health (n = 73,026). We identified statistically significant drug initiation sequences involving alcohol/cigarettes, marijuana, NMPO, cocaine, and heroin using a novel method distinguishing significant sequences from patterns expected only due to correlations induced by common liability among drugs.

Results: Alcohol/cigarettes followed by marijuana was the most common sequence. NMPO or cocaine use after marijuana, and heroin use after NMPO or cocaine, differed by generation. Among successively younger generations, NMPO after marijuana and heroin after NMPO increased. Millennials were more likely to initiate NMPO than cocaine after marijuana; Generation X and Baby Boomers were less likely (odds ratios = 1.4;0.3;0.2). Millennials were more likely than Generation X and Baby Boomers to use heroin after NMPO (hazards ratios = 7.1;3.4;2.5). In each generation, heroin users were far more likely to start heroin after both NMPO and cocaine than either alone. Sequences were similar by gender. Fewer paths were significant among African-Americans.

Conclusions: NMPOs play a more prominent role in drug initiation sequences among Millennials than prior generations. Among Millennials, NMPO use is more likely than cocaine to follow marijuana use. In all generations, transition to heroin from NMPO significantly occurs only when both NMPO and cocaine have been used. Delineation of drug sequences suggests optimal points in development for prevention and treatment efforts.

1. Introduction

Heroin use increased sharply over the last several years among nonmedical users of prescription opioids (NMPO), especially heavy and dependent users (Banerjee et al., 2016; Cerdá et al., 2015; Jones, 2013; Jones et al., 2015; Martins et al., 2016; Muhuri et al., 2013). NMPO users are also more likely than non-users to use marijuana, stimulants or cocaine (Banerjee et al., 2016; Boyd et al., 2009; Catalano et al., 2011; Han et al., 2015; McCabe et al., 2011; Wu et al., 2008; Young et al., 2012). The prevalence of legal and illegal drug use, including NMPO, has been examined across birth cohorts (Blumenthal et al., 2017; Degenhardt et al., 2007; Golub and Johnson, 2001; Johnson and Gerstein, 1998). Use of heroin and marijuana peaked in the early 1970's, cocaine in the 1980's, and NMPO in the mid-2000's. Progression through stages of drug use from nonuse to alcohol/tobacco, marijuana, and hard drugs (cocaine, heroin) observed from 1979 to 1997 for 1910–1971 birth cohorts was examined by Golub and Johnson (2001). Progression to each stage peaked with the 1960 birth cohort. To the best of our knowledge, except for that study, generational changes in developmental patterns of drug initiation in the population, in particular, pathways involving NMPO and NMPO in relation to cocaine and heroin, have not been examined.

Drug usage starts with alcohol or cigarettes and proceeds to illegal drugs, even in recent periods when rates of marijuana use surpass those

* Corresponding author at: 1051 Riverside Drive Unit 20, New York, NY 10032, USA.
E-mail address: dbk2@cumc.columbia.edu (D.B. Kandel).

https://doi.org/10.1016/j.drugalcdep.2017.10.013
Received 14 June 2017; Received in revised form 24 October 2017; Accepted 28 October 2017
Available online 27 November 2017
0376-8716/

of cigarette use (Keyes et al., 2016). Marijuana, in turn, precedes use of cocaine and other illicit substances (Cleveland and Wiebe, 2008; Degenhardt et al., 2010; Fergusson et al., 2006; Kandel, 2002; Kandel et al., 2006; Lynskey et al., 2012; Rebellon and Van Gundy, 2006; Wagner and Anthony, 2002). This progression, observed in the US and internationally, led to the notion of the Gateway Hypothesis: alcohol, tobacco or marijuana are gateways to using other substances. The notion of developmental stages in drug behavior does not imply that these stages are obligatory nor that entry into a lower stage drug inexorably leads to higher stage drugs. Translational research in rodents supports a causal mechanism through which the gateway sequence arises between two drugs. Nicotine pretreatment (in mice) and alcohol (in rats) enhances responses to later cocaine exposure but not vice versa (Griffin et al., 2017; Kandel and Kandel, 2014; Levine et al., 2011). Nicotine acts as a gateway drug and exerts a priming effect on cocaine through increased global histone acetylation in the nucleus accumbens, and this creates an environment primed for induction of gene expression.

Another perspective, the Common Liability Model, posits that use of multiple drugs reflects a common liability for drug use, with no specific influence of one particular drug leading to use of another (Palmer et al., 2009; Vanyukov et al., 2012). Generalized risks include not only common genetic predispositions but psychosocial and environmental factors including drug availability (Bailey et al., 2011; Cleveland and Wiebe, 2008; Rebellon and Van Gundy, 2006; Wagner and Anthony, 2002).

The position of NMPO use in the sequence of drug involvement remains to be established, especially nationally, and may vary between birth cohorts who differ in their drug experiences. Catalano et al. (2011) inferred an order between NMPO and other drugs from rates of use of different drugs from first grade to age 21. While Harrell and Broman (2009) concluded that alcohol and marijuana use in adolescence predicted any nonmedical prescription drug (NMPD) use six years later, including NMPO, the sequence of initiation among these drugs could not be identified because neither NMPD use at the initial interview nor onset age were ascertained. Others reported that marijuana use prior to age 18 was associated with NMPO use by age 25 (Fiellin et al., 2013), and cigarette and marijuana use by 12th grade predicted NMPO use by age 23 (Miech et al., 2015). Several studies documented that initiation of NMPO use occurred before heroin (Banerjee et al., 2016; Cerdá et al., 2015; Jones, 2013; Muhuri et al., 2013; Novak et al., 2016). This sequence became more prevalent in the population between 2002–04 and 2008–10 (Jones, 2013) and among those born after 1980 (Novak et al., 2016). Except for these studies, changes in patterns of heroin initiation in relation to NMPO and other drugs in different historical periods and at different points in the lifespan have not been examined.

Drug use is an age-graded behavior, and historical differences in prevalence of drug use experienced by different birth cohorts at ages at highest risk for drug initiation may influence the drug use careers of different generations. We consider developmental patterns of use across three generational cohorts spanning ages 18–64 in 2013–2014: Millennials (born in 1979–96), Generation X (born in 1964–79), and Baby Boomers (born in 1949–64). The birth years defining generations vary slightly across investigations (Fry, 2016; Pew Research Center, 2015), but generations provide a useful way of considering the behaviors of individuals born in different time periods. Trend data as of 1982 among 18–34 years olds illustrate that, while prevalence of lifetime use of different drug classes varied greatly over the last 40 years, the relative ranking of these drugs remained the same, except for NMPO (Supplementary Fig. 1). At ages 18–34, Baby Boomers lived through a period of increased drug experimentation, while Generation X lived through a period of decreasing prevalence of use of different drugs. Millennials experienced increases in use, especially for NMPO and heroin. Hence, we would expect sequences of drug initiation to vary across generations, especially regarding the position of NMPO.

We analyze developmental patterns of involvement in legal and illegal drugs with a focus on sequences between NMPO, cocaine, and heroin. Using a novel simulation method that distinguishes significant drug initiation sequences from patterns expected to occur by chance due to correlations induced by common liability between use of different drugs, we address the following questions: (1) what is the position of NMPO use in drug initiation sequences in three generations (Millennials, Generation X, and Baby Boomers?) and (2) what are gender and racial/ethnic differences in these patterns among Millennials, the youngest generation?

2. Methods

2.1. Sample

Data are from two aggregated surveys (2013–2014) from the National Survey on Drug Use and Health (NSDUH), annual cross-sectional surveys of drug use in multistage representative probability samples of the US population aged 12 and older (CBHSQ, 2015a,b). All states are represented. The target civilian non-instituionalized population represents over 98% of the population. Persons in non-institutional group quarters (homeless shelters, rooming houses, college dormitories) and civilians on military bases are included; individuals on active military duty, in jail, drug treatment programs, hospitals, and homeless not in shelters are excluded. Age groups at highest risk for drug use (12–17 and 18–25) are oversampled. Overall response rates were 60.2% in 2013 and 58.3% in 2014. Public use data were used for ages 18–64 (n = 73,026).

The study was granted expedited approval by the New York State Psychiatric Institute – Columbia University Department of Psychiatry Institutional Review Board.

2.2. Data

Data were collected by CBHSQ with computer-assisted personal interviews (CAPI) by an interviewer, and audio-computer assisted self-interviewing (ACASI) for substance use. Respondents were asked about use of prescription pain relievers (opioids) without a prescription or for the experience or feeling they caused; 21 pain relievers were listed.

2.2.1. Selected constructed variables

Lifetime use and onset age of cigarettes and/or alcohol, marijuana, cocaine, heroin, nonmedical prescription opioids were included. If both cigarettes and alcohol were used, onset age was set to the earlier age.

Three generations were defined: birth cohorts matched as closely as possible the generations defined by Pew Research Center (2015). Deviations were due to age groupings in NSDUH: Millennials, born in 1979–96 (vs. 1981–97 in Pew), Generation X, born in 1964–79 (vs. 1965-80), Baby Boomers, born in 1949–64 (vs. 1946–64), aged 18–34, 35–49, and 50–64, respectively, in 2013–2014. Since NSDUH groups ages and two surveys were aggregated, two birth-year cohorts (1964, 1979) were included in two generations.

The generations cover different ranges of the lifespan, ages 18–34 for Millennials, 35–49 for Generation X, and 50–64 for Baby Boomers.

2.3. Analytical strategy

Three analyses were implemented: (1) estimation of prevalence of lifetime use of the five drugs; (2) identification of significant drug initiation sequences using a novel simulation-based method; (3) estimation through survival analysis of risk of (a) NMPO or cocaine initiation next after marijuana (discrete-time survival model) and (b) heroin initiation next after NMPO or cocaine initiation (Cox proportional hazards model for dichotomous outcome). Analyses were implemented by generation, and by gender and race/ethnicity among Millennials.