



# The social exigencies of the gateway progression to the use of illicit drugs from adolescence into adulthood



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## ABSTRACT

**Background:** There is limited empirical integration between peer clustering theory and the Gateway framework. The goal of the present study was to test the hypothesis that friendship associations partly predict gateway escalations in the use of drugs from adolescence to adulthood.

**Method:** This longitudinal study analyzed 3 waves of data from a community sample of 711 male and female participants without a history of illicit drug use reporting drug use at age 17, 22, and 27. Substance use assessments including tobacco, alcohol, cannabis, onset and abuse/dependence tendency of illicit drugs other than cannabis (i.e., cocaine, methamphetamine, and opiates), and friends' reported use of illicit drugs. Structural equation modeling was used to test the hypothesized model.

**Results:** Participants' cannabis use level at age 17 was positively associated with perceived friends' drug use at age 22, which in turn predicted participants' onset of illicit drug use between ages 22 and 27. Moreover, progression of tobacco use throughout age 17 to 22 was associated with an increased onset of illicit drug use between ages 22 and 27. Apart for an effect of cannabis use at age 22 on abuse and dependence tendency to various drugs at age 28, results were similar.

**Conclusions:** During this period of development, the availability and selection of drug-using friends contributes to the progression to potentially more rewarding and damaging illicit drugs. These findings suggest the need to attend to the peer ecology in prevention and support the common practice of using abstaining peers in treatment for drug dependence.

## 1. Introduction

Drug use and dependence continues to be one of the leading causes of distress and mortality in the United States (Brady & Li, 2014; Degenhardt, Whiteford, Hall, & Vos, 2009). Next to legal drugs such as alcohol, tobacco and (to a certain extent) cannabis; cocaine, methamphetamine, and opiates are among the most pernicious illegal drugs because of the addictive quality, personal disruption, and mortality potential (Degenhardt & Hall, 2012; van Amsterdam, Nutt, Phillips, & van den Brink, 2015). Recent results of the national school-based Youth Risk Behavior Survey showed that 5.5% of students reported having used cocaine derivatives (e.g., powder, crack, freebase) one or more times during their life, 3.2% of students reported use of methamphetamines at least once, and 2.2% of students reported using heroin (Kann et al., 2014). Because of the potential for addiction and adverse effects from these drugs, a body of research attempts to

delineate the developmental pattern describing the movement from legal drugs (e.g., including alcohol, tobacco, and now cannabis) to illegal, and potentially more addictive and disruptive drugs (including cocaine, methamphetamine, and opiates) in late adolescence and adulthood.

The gateway hypothesis (GH) is the most influential framework for research on developmental progressions in drug use (Kandel, 1975; Kandel & Kandel, 2015). The GH posits that addiction is learned in the brain within the experiential context of sampling drug effects. From this perspective, adolescent use of alcohol, cigarettes, and cannabis may progress to more severe levels of use of these drugs, yet also to the use of other sometimes more rewarding and damaging drugs (Kandel & Kandel, 2014, 2015). Accordingly, one way of preventing serious drug use and addiction is to restrict access and motivation for adolescent use of alcohol, cigarettes and cannabis. With respect to cigarette and alcohol use, empirical support for the GH is robust

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(Kandel & Kandel, 2014; Woodcock, Lundahl, Stoltman, & Greenwald, 2015). For instance, among 18- to 34-year-olds, 96.9% of individuals first started either smoking or drinking before they started using cocaine. Only 0.8% initiated their drug use with cocaine (Substance Abuse and Mental Health Services Administration (SAMHSA), 2013).

Animal models of addiction provide strong support for biological mechanisms underlying the GH. For instance, Kandel and Kandel (2014) suggest that exposure to nicotine in mice significantly elevated (by 98%) the locomotor response to cocaine, whereas cocaine did not change the baseline activity of nicotine. In addition, studies showed that repeated exposure to tetrahydrocannabinol (one of the main psychoactive ingredients of cannabis) enhances the sensitivity of the reward system to other drugs (DiNieri & Hurd, 2012; Schenk, 2002), referred to as *cross-sensitization*. These findings suggest that, if left unfettered, youth will progress naturally from alcohol, cigarettes, and cannabis to other drugs in ecologies where both legal and illegal drugs are readily available.

Within the traditional GH framework, cannabis takes a central role in the progression to use of other drugs, partly because of its controversial status with respect to legalization. However, what remains unclear is its unique status as a gateway drug relative to alcohol and tobacco use. First, the majority of people who use cannabis actually do not go on to use other more addictive drugs (Hall & Lynskey, 2005). Second, in some cases, cannabis use precedes the use of alcohol and tobacco (Golub & Johnson, 2002). For example, in a nationwide survey, 35% of individuals reported that they either started cannabis first or started cannabis and drinking/smoking at the same time (Substance Abuse and Mental Health Services Administration, SAMHSA, 2013). Third, posing cannabis as the *core* link between the legal and illicit drug use may be oversimplifying the human dynamics of drug use progressions (Kleinig, 2015). It is argued that experimentation and progression of illicit drug use among humans is more complex than in animal models, which neglect the social ecology.

For example, the strongest correlate of drug use initiation is exposure to substance-using peers (Dishion & Loeber, 1985; Kandel, 1973). Attitudes towards drug use are a salient dimension for youth clustering into friendship groups (Kandel, 1978; Otten, Wanner, Vitaro, & Engels, 2008). Moreover, peer clustering is a robust predictor of progressions from early drug experimentation to escalating use and dependence by early adulthood (Van Ryzin & Dishion, 2014). If the social norms of illicit substance use suggest acceptability and harmlessness, then experimentation will likely ensue (Hawkins, Hill, Guo, & Battin-Pearson, 2002). As friendships evolve through adolescence, the dynamics embedded in selection and influence increase accessibility, opportunities, and an ecology more favorable to use and abuse of illicit drugs (Dishion & Owen, 2002).

However, to date there is limited empirical integration between peer clustering theory and the GH framework (Vanyukov et al., 2012). Hence, the main goal of the present study is to examine peer influence in the context of the GH framework: (1) replicating the findings of the gateway hypothesis by examining whether cannabis use mediates the link between alcohol and tobacco use and illicit drug use onset and abuse/dependence tendency; and (2) extending the GH by investigating whether affiliation with friends who use illicit drugs can increase the likelihood of illicit drug use onset and abuse/dependence tendency (Fig. 1). We expect that, in addition to the well-established mediating effect of cannabis use, affiliation of drug-using peers will emerge as another gateway to other illicit drug use.

## 2. Material and methods

### 2.1. Participants

The initial sample consisted of 998 adolescents and their families from a large randomized control trial of the Family Check-Up (FCU) intervention (Dishion & Stormshak, 2007). Participants were recruited

from the sixth grade (age 11) of three public middle schools in the Pacific Northwest of the United States. Parents were approached for participation, 90% of them consented to participate. The Institutional Review Board at the University of Oregon approved the study procedures. Participants included 47.3% females and were ethnically diverse (42.4% Caucasians, 29.2% African Americans, 6.8% Hispanics, 5.2% Asian Americans, and 16.4% other). Gross annual household income ranged from \$5000 to more than \$90,000, with a median household income between \$30,000 and \$40,000. The longitudinal retention was on average 80% of those participants assessed at baseline through age 27.

Among the 998 participants, 79 participants with missing data on all study variables, 150 participants who reported use of illicit drugs other than cannabis at age 22, and 58 participants who had missing data on those drugs at age 22 were excluded. The final sample for analysis included 711 participants. Compared to participants who did not report any use of illicit drugs other than cannabis at age 22, those who *did* report having used drugs at age 22 came from higher income families ( $t = 4.596, p < 0.001$ ), reported higher levels of cannabis use at age 17 ( $t = 9.641, p < 0.001$ ), higher levels of tobacco use ( $t = 7.208, p < 0.001$ ), and higher levels of alcohol use ( $t = 9.199, p < 0.001$ ). Moreover, they were more likely to have friends who reported lifetime use of illicit drugs at age 17 ( $\chi^2(1) = 20.041, p < 0.001$ ) and age 22 ( $\chi^2(1) = 172.442, p < 0.001$ ).

### 2.2. Procedure

Participants were assessed by a questionnaire administered primarily through the schools at age 17, and then by mail in adulthood. All respondents were assured of the confidentiality of their responses. Participants were adequately compensated for their participation.

At age 11, participants were randomly assigned at the individual level to control (middle school as usual) or to the family-centered intervention. Within the intervention, at-risk families were offered a Family Check-Up (FCU). Dishion and Kavanagh detail the description of the FCU intervention (Dishion & Kavanagh, 2003). The focus of this study is not to examine the effect of FCU intervention on this proposed developmental substance progression model. Recent research suggests that random assignment to the FCU at age 11 was linked to modest reductions in cannabis use by age 24 using an intent-to-treat analysis, and to moderate to large effects on cannabis, tobacco, and alcohol use when intervention engagement was a moderator (Véronneau, Dishion, Connell, & Kavanagh, 2016). Because of the modest effects on young adult cannabis use, the intervention group assignment was included as a covariate in the model.

### 2.3. Measures

#### 2.3.1. Cannabis use

Participants at age 17 and 22 reported on their cannabis use in the past three months by using an 8-point Likert scale (0 = "Never"; 1 = "Once or twice"; 2 = "Once a month"; 3 = "Once every 2–3 weeks"; 4 = "Once a week"; 5 = "2–3 times a week"; 6 = "Once a day" 7 = "2–3 times or more a day") (Piehler, Véronneau, & Dishion, 2012).

#### 2.3.2. Tobacco use

Participants at age 17 and 22 reported on their tobacco use in the past three months by using the same 8-point Likert scale as used for cannabis use (Piehler et al., 2012).

#### 2.3.3. Alcohol use

Participants at age 17 and 22 reported on their alcohol use over the previous three months separately for these three questions: "How often did you drink beer in the past three months?" "How often did you drink wine/wine coolers in the past three months?" and, "How often did you drink hard liquor in the past three months?" (Piehler et al., 2012). We

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