

The Sequence of Drug Use: Testing the Gateway Hypothesis in Latin America

Eduardo Valenzuela and Matías Fernández
Instituto de Sociología, Pontificia Universidad Católica de Chile

This article presents evidence obtained from general population surveys in Latin America on the hypothesis of the sequence of drug use, which begins with legal drugs, followed by the use of marijuana, and ends with abuse of hard drugs. The findings confirm that both the occasional and the drug-dependent users follow this sequence. Special attention was given to the “gateway effect” of marijuana and to the role of early age of onset of tobacco and alcohol use in the progression to hard drug use. Two factors are analyzed in depth: the decreased perception of risk among those who started using a drug about the next drug in the sequence as well as the increased exposure to it.

Keywords: gateway drugs, Latin America, epidemiology

Introduction

Main propositions

The notion of the developmental stages and sequences in drug use can be traced back to Kandel’s research conducted some 30 years ago (Kandel, 1975). Evidence from multiple research studies implemented in different parts of the world, particularly in English-speaking countries, indicate that, while variable, there is a progression through a sequence of stages in a hierarchy of drugs. This hierarchy begins with tobacco and alcohol consumption, is followed by marijuana, and moves to hard drugs such as cocaine and heroin at a later stage. The underlying premise is that this sequence is neither random nor opportunistic, but follows well-defined pathways: licit drugs open the door to marijuana use, and this drug, in turn, opens the gate to drugs with greater addictive potential such as cocaine or heroin (Kandel, 2002). The link between the consumption of different substances is of great importance for the development of prevention and treatment policies. Nevertheless, there has been no evidence in a Latin American context until now that allows us to certify this relationship, which is why the present investigation describes absolutely novel results in the Latin American context.

Although the gateway hypothesis has been described as an unavoidable progression following the onset of drug use (Leshner, 2002), the hypothesis as purported by Kandel (2002) describes the gateway phenomenon under three

propositions: (1) evidence of sequences of onset of use of different drugs; (2) the evidence of a non-spurious association in drug use; and (3) the evidence of causal links in the hierarchical sequence. While support and consensus on propositions (1) and (2) is overwhelming, the causal proposition (3) is still a matter of dispute.

In the first case (1), it has been generally observed that tobacco and alcohol use begins at an earlier age with respect to marijuana initiation, and that marijuana initiation also occurs at an earlier age compared to cocaine/heroin initiation. The ages of initiation into tobacco/alcohol use may vary, but generally precede the ages of onset of marijuana use. It is also rather common to see that the age of initiation into any illicit drug other than marijuana (except for inhalants) comes later than for marijuana.

Second (2), there is an association between the age of initiation of drug use and the different drugs used, where some drugs are considered the “gateway” to the next. Research indicates that initiation in the ‘softer’ drugs increases the odds of subsequently using ‘harder’ drugs. This association continues to exist when common underlying factors are controlled for (Lynskey et al., 2003; Van Ours, 2003; Fergusson, Boden, & Horwood, 2006). This is certainly not a universal progression. Most drug users stop at some stage of the sequence. Those initiated into tobacco/alcohol consumption do not necessarily move to marijuana, and many of those who begin using marijuana never progress into cocaine/heroin use. However, there is a greater risk of progressing through the sequence for those who have already initiated the use of any drug. A sizable part of the research conducted on drug use sequence has been dedicated to establishing the nature and scope of this risk.

(3) Researchers have not established a causal link in the gateway theory (Kandel, Yamaguchi, & Chen, 1992; Hall & Pacula, 2003; Lynskey et al., 2003; Bretteville-Jensen, Melberg, & Jones, 2005). There may be some evidence in this regard (Fergusson et al., 2006); however, causality operates as a tacit assumption of the gateway hypothesis.

Eduardo Valenzuela, M.D., Instituto de Sociología, Pontificia Universidad Católica de Chile, Núcleo Científico Milenio de Investigación Socio-Económica en Uso y Abuso de Drogas And Red Latinoamericana de Investigadores en Drogas (REDLA). Vicuña Mackenna 4860, Macul, Santiago, Chile, 7820436, Sociología. Fax: (56)(2)5521834; Phone: (56)(2)3544651. E-mail address: evalenzc@uc.cl.

Matías Fernández, Instituto de Sociología, Pontificia Universidad Católica de Chile. Vicuña Mackenna 4860, Macul, Santiago, Chile, 7820436, Sociología. Fax: (56)(2)5521834; Phone: (56)(2)3541792. E-mail address: mjfernand@uc.cl.

Factors in the progression

One of the most relevant factors influencing progression in drug use sequences may be early drug use. The earlier the age of drug initiation, the greater are the risk of progression. Late initiation provides a more limited period of time to advance through a sequence; hence, drug use often ceases in adulthood (Labouvie & White, 2002). By the same token, the age of initiation becomes a crucial variable in predicting the likelihood of drug use trajectories (Labouvie & White, 2002; Kandel & Yamaguchi, 2002; Lynskey et al., 2003; Agrawal, Neale, Prescott, & Kendler, 2004; Lynskey, Vink, & Boomsma, 2006). Nevertheless, the most consistent result of the drug use sequence is the association with intensity of use. Frequent or regular use of the preceding drug may predict the transition to the next drug (Newcomb & Bentler, 1986; Degenhart, Hall, & Lanskey, 2001; Labouvie & White, 2002; Fergusson et al., 2006; Bretteville-Jensen et al., 2005).

Both factors may influence each other reciprocally; the earlier the age of initiation, the greater the odds of developing drug abuse. There is a relationship between precocity and intensity, which compels us to distinguish between recreational drug use and abusive drug use (Labouvie & White, 2002; Pedersen & Skrandal, 1998). The intensity of use permits this distinction, as frequent use always predisposes serious and problematic involvement with drugs.

Studies found a risk in that tobacco initiation leads to alcohol initiation (but not the reverse) (Kandel & Yamaguchi, 2002), and both lead to marijuana (Hawkins, Hill, Guo, & Battin-Pearson, 2002). Early marijuana use, especially when associated with a frequent use pattern, is highly correlated with the risk of escalation to harder drugs (Kandel & Yamaguchi, 2002; Labouvie & White, 2002; Fergusson et al., 2006; Bretteville-Jensen et al., 2005). Other studies refer to the relationship between cocaine and heroin (Kandel & Yamaguchi, 2002).

Studies conducted on individuals who are heavy users of hard drugs show that the most serious cases have not always followed the sequence (Golub & Johnson, 1994; Golub & Johnson, 2002; Mackesy-Ami, Fendrich, & Goldstein, 1997). Another fairly solid finding is the fact that the risk for progression is higher among teenagers (Fergusson, et al., 2006). Lynskey's research on twins documented that both genetic and environmental influences can be controlled for (Lynskey et al., 2003; Lynskey, Vink, & Boomsma, 2006).

The determinants of the drug use sequence are not yet clear. The sequence appears to follow a gradient of perceived risk and social acceptability. The social norms of acceptability and risk have a distinctive role in the onset of drug use. Research indicates that for tobacco and marijuana, a decreased perception of the risk associated with use increases the likelihood of eventually trying those drugs (Hawkins et al., 2002; Kandel & Yamaguchi, 2002). This shift in the acceptance and risk norms regarding the later drug has usually been explained as a "learning effect": the rejection and fear of more dangerous drugs is attenuated when the experience with the preceding drug apparently did not lead to the anticipated effects.

The effects of the "differential association" are also significant in attenuating the risk: drug use is commonly done

in the context of peers who use drugs, providing many opportunities for vicarious learning (Fergusson et al., 2006). This increased accessibility is crucial to the transition from marijuana to cocaine/heroin: the segmentation of the licit and illicit drug markets makes this progression relatively harmless, as the contact that those who are trying tobacco/alcohol have with the marijuana distribution rings is irrelevant. However, this is not the case for the illicit distribution rings, as the probability for those using marijuana to be lured into cocaine/heroin offers is greater (Kandel, 1978).

The present investigation intends to test the existence of the link between drugs, intensities of use and some hypotheses that could explain this relationship, especially with regard to the age of onset in consumption, the perception of risk and the exposure to drug offers. In line with the bibliography, we expect that the use of legal drugs starts earlier in the sequence than the use of illegal drugs and among these, marijuana starts earlier than the rest. In addition, we intend to evaluate the hypothesis that the age of onset would present a positive association with drug dependency and with the stage reached in the sequence. Finally, we aim to prove that drug consumption implies a fall in the perception of risk of hard drug consumption among consumers and an increase in the exposure to hard drugs for non-hard drug consumers. The corroboration of the aforementioned hypotheses would more broadly point to the existence of a gateway drug consumption in Latin America and would also imply the possibility for the development of explanatory mechanisms in future studies.

Methods

Study population and sample design

The data analyzed are based on a cross-sectional survey carried out by six South American countries (subregion). The survey took place during the last quarter of 2006 in Argentina, Chile, Uruguay, and Peru, whereas in Ecuador and eastern Bolivia this process was carried out the first quarter of 2007. The study population was defined as the urban population of both sexes, ages 12 to 65.

A household survey was conducted in each country a complex, multistage, stratified cluster sample design survey. A three-stage sampling design targeting the population aged 12 to 65 was used. In the first stage, enumeration districts (EDs) were selected. Selection of EDs in the strata was carried out using the national census bureau or equivalent in each country. The number of EDs sampled in a particular stratum varied according to the population size. The second selection stage consisted of a random selection of households from each ED. In the final stage, one eligible individual was randomly selected from each household and invited to participate in the study.¹ With the exception of Chile, all

¹ All countries took into account theoretical sample sizes including a percentage of oversample to guarantee the non-replacement of non-effective cases. Every selected person was visited at least three times.

Table 1
Sample Size and Population Aged 12–65 Represented by Country

	Theoretic sample	Effective sample	Population
Argentina	19,084	13,493	17,376,574
Bolivia	14,166	9,533	3,254,256
Chile	23,796	17,192	8,876,262
Ecuador	10,610	7,954	4,494,119
Perú	12,884	11,825	11,318,495
Uruguay	22,000	7,000	1,602,844
Total	102,540	66,997	46,992,550

Note. From *Elementos orientadores para las políticas públicas sobre drogas en la subregión: Primer estudio comparativo sobre consumo de drogas y factores asociados en población de 15 a 64 años* by Naciones Unidas Oficina contra la Droga y el Delito (ONUDD), 2008, Lima, Perú: Author.

the countries conducted pilot tests of the instruments and the methodology.²

The non-response rates and the reasons given vary according to the countries. Table 1 shows the sizes of sample and population for the different countries. The results in the present study are almost exclusively based on people aged 12–40, the population segment in which the gateway hypothesis would be best proven.

Calculation of indicators

The data presented are focused on the evaluation of some basic propositions of the gateway hypothesis in Latin America; the data of the six countries studied is considered together. The six countries share a common language and historical and cultural tradition that allows the researcher to study them jointly. The major differences come from the level of economic development that allows us to identify two groups of countries. Uruguay, Argentina, and Chile represent the first group, as in 2007, they each had a GDP per capita between \$12,000 and \$15,000. Peru, Ecuador, and especially Bolivia, on the other hand, all had considerably smaller per-capita incomes. This difference is relevant since it significantly affects the rates of drug prevalence: the three countries of the Southern Cone have drug consumption rates that are notoriously higher than in Peru, Bolivia, and Ecuador, despite the fact that these countries—especially Peru and Bolivia—are among the main producers of cocaine on the global level, according to the *World Drug Report* (UNODC, 2010). Thus, consumption seems to depend much more on the level of economic development than on the level of the production of illicit substances.

We applied a direct method of standardization to fit the rates of consumption, considering the differences in the population structures (according to sex and age). This way, the rates are not influenced by variation samples in the age and sex structure of the countries.

² Chile did not conduct this test because it counted on an experience of seven previous studies in general population applying a standardized questionnaire.

The data were obtained by applying a standardized questionnaire to the key variables to compile comparable basic information about the following: socio-demographic prevalence, incidence, age of onset, drug dependency (*DSM-IV*), and alcohol abuse (Brief Scale of Abnormal Drinking Behavior [EBBA] scale). The variables measuring the intensity of consumption, as well as those referring to risk with respect to drug use have also been standardized.

Some key indicators have been used in order to evaluate the gateway hypothesis. **Drug use sequence** has been calculated based on **lifetime prevalence**, i.e., if interviewees declare having ever consumed substances. **Last year prevalence** refers to the declarations of substance consumption during the last 12 months. **Age of onset** refers to the age the interviewee reports having consumed substances for the first time.

In order to count on a sufficient number of cases to identify a tendency, in some cases, we used the variable “some cocaine”—chlorhydrate cocaine and *pasta base*. In spite of the differences they present, both are made of cocaine and are classified as hard drugs.

Drug dependency was measured according to *DSM-IV* criteria, whereas the **problematic consumption of alcohol** was measured by the EBBA, based on seven questions.³ A person is classified as a problem drinker when he or she has consumed alcohol in the last 30 days and responds positively to two or more of the previous indicators.

Risk perception is used in the present investigation as a key variable to explain the gateway hypothesis: the consumption of a drug in the sequence would affect the future consumption of harder drugs because of a decreased risk perception of its use. In this sense, risk perception has been defined as an indicator of a “subjective barrier” for consumption (ONUDD, 2008). Risk perception was evaluated through the following question: “In your opinion, how dangerous is it for a person to...?” In addition, the frequencies of use of different substances are specified. **Experimental use** refers to how the interviewee conceives of the risk that a person runs who “uses the substance once or twice.” **Regular use** refers to the risk run by those who consume the substance “frequently.”

Finally, the **exposure to drug supply** refers to the “objective barrier” to obtain drugs (which allows us to evaluate the differential association hypothesis in the market). In the present study, a person is considered to have been exposed to drugs if he/she has been offered any substances in the last 12 months.

Results

Table 2 shows the distribution of the drug sequence among those who have used the five drugs listed in the table. In the

³ “Have you ever had any problems with your fiancé/fiancée husband/wife girlfriend/boyfriend because of alcohol consumption?”; “Have you ever lost a friend(s) because of drinking?”; “Have you ever thought of drinking less than usual?”; “Have you ever drank more than you wanted, though inadvertently?”; “Have you ever felt the need to drink just after waking up or getting up?”; “Have you ever forgotten what had happened or you had done the night before?” and “Have you ever felt upset for being criticized for your drinking?”

Table 2
Distribution of Sequential Stages of Drug Use in Subregional Population Age 12/18–40 Compares with Data from the United States

	NONE	Tobacco/alcohol	Marijuana	Cocaine/pasta base	Heroin
Subregion ages 12–40	19.9% (19.5–20.2)	64.6% (64.2–65.1)	9.4% (9.1–9.7)	5.7% (5.5–5.9)	0.2% (0.16–0.25)
Subregion ages 18–40	11.5% (11.1–11.8)	70.6% (70.1–71.1)	10.8% (10.5–11.2)	6.6% (6.3–6.9)	0.2% (0.19–0.29)
United States ages 18–40 (1994/1995) ^a	7.7%	42.5%	28.6%	15.1%	1.1%

Note. 95% confidence interval in parentheses.

^a From “Stages of drug involvement in the U.S. population” by D. B. Kandel and K. Yamaguchi, 2002, in D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. 65–89). New York: Cambridge University Press.

group aged 18–40, the largest proportion (71%) initiate tobacco or alcohol and did not go on to use any other substance. In addition to those who used alcohol or tobacco, 11% progressed to marijuana. Approximately, 7% progressed to cocaine/pasta base stage after having used marijuana. The transition to heroin was only 0.2%. The comparison with U.S. data (Kandel & Yamaguchi 2002) shows that the transition to illicit drugs is much less important in the subregion (only 15% crossed the line to illicit drugs while 46% did so in the United States).

Table 3 shows the average age of initiation into different substances, as described by Kandel and Yamaguchi (2002), with American data for the population aged 18–40. In all of the

cases, even when the adolescent population aged 12–17 is included, the earliest substance used is tobacco. Alcohol comes after tobacco with a similar distribution across groups. Marijuana onset comes next in the sequence at a consistently later date than tobacco and alcohol.

Table 4 shows the sequential order of consumption for a given pair of substances, during or after the same year. For the tobacco/alcohol pairing, 37% initiated tobacco prior to alcohol use, 36% initiated tobacco and alcohol use during the same year, and 27% initiated alcohol use prior to tobacco. For tobacco/marijuana, 74% of the respondents who have used both tobacco and marijuana in their lifetime started using

Table 3
Mean Age of Onset into Five Drug for the Subregional Population Age 12/18–40 Compared With U.S. Data

	Tobacco	Alcohol	Marijuana	Cocaine	Pasta base
Subregion ages 12–40 years	16.5 (16.5–16.5)	16.9 (16.9–16.9)	17.7 (17.7–17.8)	18.8 (18.8–18.9)	19.1 (19.0–19.1)
Subregion ages 18–40 years	16.8 (16.8–16.9)	17.4 (17.3–17.4)	18.1 (18.0–18.1)	19.2 (19.2–19.3)	19.6 (19.5–19.6)
United States, ages 18–40 years (1995/1996) ^a	14.3	16.2	16.6	20.2	—

Note. 95% confidence interval in parentheses.

^a From “Stages of drug involvement in the U.S. population” by D. B. Kandel and K. Yamaguchi, 2002, in D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. 65–89). New York: Cambridge University Press.

Table 4
Sequential Order of Initiation into Drugs in Population Age 12–40

	Tobacco Alcohol	Tobacco Marijuana	Alcohol Marijuana	Marijuana Cocaine	Marijuana Pasta base	Cocaine Pasta base
Before	36.9% (36.2–37.5)	73.8% (72.5–75.1)	68.3% (67.0–69.6)	52.1% (49.5–54.8)	54.3% (50.1–58.5)	33.1% (28.2–38.1)
Same year	35.6% (35.0–36.3)	17.4% (16.3–18.5)	21.0% (19.8–22.2)	43.8% (41.1–46.4)	40.1% (36.0–44.3)	43.6% (38.4–48.8)
After	27.5% (26.9–28.1)	8.8% (8.0–9.6)	10.7% (9.8–11.6)	4.1% (3.1–5.2)	5.6% (3.6–7.5)	23.3% (18.9–27.7)

Note. 95% confidence interval in parentheses.

Table 5

Mean Age of Drug Onset Reported by Drug-dependent and Non-drug Dependent Users of Some Cocaine in Population Age 12–40

	Tobacco	Alcohol	Marijuana	Some cocaine
Dependent	13.5 (13.1–13.9)	13.7 (13.2–14.1)	15.6 (15.0–16.1)	17.9 (17.2–18.5)
Non-dependent	14.5 (14.2–14.8)	14.4 (14.2–14.6)	17.0 (16.6–17.4)	19.9 (19.5–20.4)

Note. 95% confidence interval in parentheses. *DSM-IV* dependence.

tobacco first, followed by marijuana. For alcohol/marijuana pairings 68% of the respondents started using alcohol first, prior to marijuana. Counterfactually, only 10% of the individuals reported having used marijuana before tobacco/alcohol. Similar results are found for marijuana/cocaine and marijuana/*pasta base*. The proportions of people who initiated cocaine or *pasta base* use before marijuana are very small, 4% and 6% respectively. Initiation of both substances during the same year is most common for the marijuana/cocaine pairing (44%).

Some studies show that heavy users do not exhibit sequence in drug use (Golub & Johnson, 1994; Golub & Johnson, 2002; Mackesy-Amity et al., 1997). By taking as a reference the population that self-reports current dependency on cocaine/*pasta base* according to the *DSM-IV* criteria, the subregional information does not confirm that heavy users are an exception. As illustrated in Table 5, the data prove that the sequence measured in terms of average age of initiation is unbroken in the dependent population; the only difference is the precocity of those that report being currently dependent, who usually tend to start using any substance well before those non-dependent users. The tobacco/alcohol precedence with respect to marijuana, and marijuana precedence with respect to cocaine, did not experience any variation, and was distributed as envisaged by the drug sequence hypothesis.

Table 6 shows the average age of initiation into any kind of drug use according to the level of advancement into drug

sequences. We can observe in this table that the age of initiation into any substance is consistently lower among those who are more advanced in the drug use sequence. For example, in the case of tobacco, the age of initiation of those who stopped at tobacco/alcohol use only without progressing to illicit drugs is 17. This age also applies for those who initiated alcohol use and did not advance further along the sequence of drug use. Conversely, as respondents move up through the sequence of drug use, the age of initiation decreases systematically. Among those who progressed on to marijuana, the average age of initiation into tobacco was 15.4 years. The age of initiation of tobacco drops to 14.9 among those who progressed into cocaine/*pasta base* and drops to 13.7 years for the small group initiated into heroin.

Table 7 shows the rate of those reporting hazardous alcohol use or abuse according to the stage reached in the drug sequence. The rate of alcohol hazardous abuse (EBBA abuse) varies from 16% among subjects who have tried only alcohol and progressed no further in the drug use sequence to 51% among those who have reached cocaine/*pasta base* in the drug use sequence. Among those who progressed to marijuana use and no further, the rate of hazardous alcohol use/abuse is 39%. The result for marijuana dependence (*DSM-IV* criteria) is similar: dependence among those that tried marijuana and progressed no further in the drug use sequence is 17%, but it rises to 48% among those who have advanced to use of cocaine/*pasta base*. Likewise, those that advanced to cocaine/*pasta base* are almost three times more likely to be marijuana dependent than those who stopped at the marijuana stage in the drug use sequence.

Table 8 illustrates a well-known finding: early initiation not only predicts longer trajectories through the sequence, but it may also predict abuse and dependence risks. For instance, in the case of marijuana, the rate of respondents reporting dependence in the *DSM-IV* criteria systematically drops in line with the age of onset, which is 45% for those who first smoked before age 15. It then goes down to 22% and 18% for those who did so for the first time after age 15.

Table 9 displays cocaine dependence by age of initiation. We can observe that 50% or more of the subjects who initiated use

Table 6

Mean Age of Drug Onset by Stage Reached in the Drug Use Sequence in Population Age 12–40

	Advancement in Drug Use Sequence			
	Tobacco/alcohol	Marijuana	Cocaine/ <i>pasta base</i>	Heroin
Tobacco	17.0 (16.9–17.0)	15.4 (15.3–15.5)	14.9 (14.7–15.0)	13.7 (13.1–14.3)
Alcohol	17.2 (17.2–17.2)	15.9 (15.8–16.0)	15.1 (15.0–15.2)	14.6 (14.0–15.3)
Marijuana	—	18.1 (18.0–18.2)	17.1 (17.0–17.3)	15.8 (15.1–16.5)
Cocaine	—	—	18.8 (18.7–19.0)	17.8 (17.1–18.5)
<i>Pasta base</i>	—	—	19.1 (18.9–19.3)	18.5 (17.3–19.7)

Note. 95% confidence interval in parentheses. Stage reached calculated based on life prevalence.

Table 7
Intensity of Alcohol and Marijuana Use by Stage Reached in the Drug Use Sequence in Population Age 12–40

	Only alcohol	Marijuana	Cocaine/pasta base
Alcohol abuse (EBBA)	16% (15.7–16.7)	39% (37.8–40.8)	51% (49.2–53.6)
Marijuana dependence (<i>DSM-IV</i>)	—	17% (15.7–18.1)	48% (45.4–49.8)

Note. 95% confidence interval in parentheses. Stage reached calculated based on life prevalence.

Table 8
Marijuana Dependence According to the Age of Onset into the Drugs Indicated Below. Last Year Prevalence in Population Age 12–40 Years

	Before age 15	At ages 15–17	After age 17
Tobacco	32.5% (29.3–35.8)	23.7% (20.2–27.2)	6.7% (5.6–10.2)
Alcohol	31.3% (28.0–34.6)	22.8% (19.8–25.9)	8.5% (4.5–12.5)
Marijuana	45.3% (39.6–51.0)	21.9% (18.8–25.0)	18.1% (15.1–21.0)

Note. 95% confidence interval in parentheses. *DSM-IV* dependence.

Table 9
Cocaine Dependence According to Age of Onset into The Drugs Indicated Below. Last Year Prevalence in Population Age 12–40 Years

	Before age 15	At ages 15–17	After age 17
Tobacco	49.9% (44.4–55.4)	36.0% (27.9–44.2)	39.4% (26.8–52.0)
Alcohol	49.5% (43.8–55.2)	25.8% (19.4–32.2)	51.2% (37.9–64.4)
Marijuana	62.6% (54.4–70.8)	33.6% (26.9–40.3)	41.5% (33.4–49.6)
Some cocaine	95.6% (85.6–105.6)	61.7% (43.1–80.4)	57.0% (45.4–68.6)

Note. 95% confidence interval in parentheses. *DSM-IV* dependence.

before age 15 showed signs of dependence (*DSM-IV*). This figure leaps to an incredible 96% among those who initiated cocaine/pasta base use before 15.

Table 10 shows the perception of risk as reported by subjects according to the stage of advancement in the drug use sequence. We can observe that subjects who progress through the drug use sequence only up to initiating marijuana report a significantly lower risk perception associated with cocaine use than those who have never tried marijuana. In other words, marijuana users perceive a lower risk associated with cocaine than non-marijuana users.

Perceptions of high risk associated with experimental cocaine use vary according to the type of drugs used. Roughly 80% of subjects who use only tobacco consider the experimental use of cocaine to be of high risk. Similarly, 74% of subjects who only use alcohol consider it high risk.

However, only 56% of marijuana consumers perceive the experimental use of cocaine to be of high risk.

The rate of respondents viewing a risk in frequent alcohol use is nearly 80% for those who only tried tobacco/alcohol, but it declines sharply to 64% for those who have already initiated into marijuana. The same applies in the case of those who have tried cocaine/pasta base: their risk perception regarding frequent marijuana use (not experimental use thereof) drops from 59% to 49%.

Table 11 shows exposure to being offered drugs during the past year, by stage reached in the drug sequence during the past year. About 24% of those using marijuana have been offered cocaine during the last year. Only 4% of those who have never tried marijuana were offered cocaine during the past year. Those who have been initiated into marijuana use were six times more likely to have been offered cocaine. The proportion

Table 10

Risk Perception Regarding Drug Use by Stage Reached in the Drug Use Sequence Last Year, Population Age 12–40

	None	Only tobacco	Only alcohol	Marijuana	Cocaine/ <i>pasta base</i>
Regular alcohol use (use frequently)	85% (85.0–85.6)	84% (83.1–83.8)	81% (80.7–81.4)	64% (63.3–64.3)	62% (61.0–61.9)
Experimental use of marijuana (once or twice)	73% (72.4–73.3)	67% (66.6–67.5)	60% (59.5–60.4)	20% (20.0–20.8)	25% (24.1–24.9)
Regular marijuana use (use frequently)	92% (92.1–92.6)	90% (89.3–89.9)	90% (89.7–90.3)	59% (59.0–59.9)	49% (48.8–49.7)
Experimental use of cocaine (once or twice)	79% (78.5–79.3)	80% (79.5–80.3)	74% (73.9–74.7)	56% (55.3–56.2)	49% (48.5–49.5)
Experimental use of <i>pasta base</i> (once or twice)	80% (79.1–79.9)	82% (81.9–82.6)	79% (78.7–79.5)	79% (78.2–79.0)	70% (69.0–69.9)

Note. 95% confidence interval in parentheses.

Table 11

Exposure to Drug Supply Over Last Year by Stage Reached in The Drug Use Sequence During Last Year in Population Age 12–40

	Only tobacco	Only alcohol	Marijuana	Cocaine	<i>Pasta base</i>
Marijuana	7% (6.6–7.1)	11% (11.1–11.7)	76% (75.5–76.3)	79% (78.6–79.4)	65% (64.5–65.5)
Cocaine	3% (2.6–2.9)	4% (4.2–4.6)	24% (23.1–23.9)	74% (73.6–74.4)	34% (33.5–34.5)
<i>Pasta base</i>	2% (1.7–1.9)	3% (2.9–3.2)	13% (12.7–13.3)	23% (22.6–23.4)	72% (71.6–72.4)

Note. 95% confidence interval in parentheses. Stage reached calculated based on life prevalence.

of *pasta base* offers among those using marijuana is a little less, although it is four times greater than those who smoked marijuana; this difference is statistically significant.

Conclusion

The information in this article from the six South American countries that participated in this study provides evidence that the sequence of drug use as described by previous literature holds true for this region. There are some obvious limitations to the results presented in this study. Firstly, this research is based on self-reported data. Since the questions of our survey focused on a socially censured behavior, the statements of some interviewees are not likely to be reliable. Secondly, the assessment of alcohol abuse and drug dependence has been attained through global indicators that are naturally subject to a margin of error and can never reach the accuracy of a psychiatric diagnosis. Thirdly, the data presented in this study have been gathered through a cross-sectional design, which could be more susceptible to spurious associations than the longitudinal model. However, the adoption of a longitudinal model was not feasible in the subregional context of our research.

The sequence begins with alcohol and tobacco use, followed by the use of marijuana, and finally extending to cocaine, cocaine type substances and other drugs. Although there is a

very low prevalence of heroin use in these countries, in the few cases reported heroin is the final stage of the sequence, which is similar to previous research. The cocaine-type substance *pasta base* is located in the same place in the sequence as cocaine, with ages and times of onset that are practically the same for both substances. The strength of the drug sequence is consistent, at least considering the available data: the population reporting dependence on any drug (although identified by self-report questionnaires that may be very inaccurate in this respect) also followed the same sequence.

Not all of those who use any drug at all would go through the complete sequence. On the contrary, most consumers stop at the initial tobacco/alcohol stages, and as for those who move on to illicit drugs, many stop at marijuana, while those going on to the higher cocaine/*pasta base* stage are a minority. The factors involved in the progression through the sequence are well analyzed and are also present in the data: early use and intensity of use. These data show that those who reached the more advanced stages of the sequence are also those who started using the first or preceding drugs at an earlier age: it is usual to find earlier use of tobacco/alcohol among those transitioning to marijuana, and earlier use of marijuana for those who have moved on to cocaine/*pasta base*. The same finding applies to intensity of use: those moving through the sequence show greater signs of abuse/dependence on the first or preceding drugs. It is more likely to find alcohol abuse

among those who moved into marijuana, and there are higher marijuana dependence rates among those progressing into cocaine/*pasta base* than for those who stopped in the sequence. The constraints of a cross-sectional study do not allow us to notice the direction of this association. The literature is clear that the intensity of use of the preceding drug predisposes the user toward using a later (harder) drug. But it could also happen that the transition to the next drug may increase the use of the preceding drug. This particular analysis does not allow us to answer this question, and is a potential area for further research.

The drug use sequence is distinctly organized in a gradient of risk perception and availability found in these countries. The risk associated with various substances follows a progression matching the sequence of use: the perception of risk for tobacco/alcohol is low; it is a little higher for marijuana, and definitively higher for cocaine/*pasta base*. The same applies to perceived availability to drugs. But the data in this study show that risk perception and availability vary according to how far the respondent has advanced in the sequence. Advancement to marijuana use plays a critical role: marijuana initiation has a dramatic impact on the decreased perception of risk associated with using cocaine. This pattern is less clear among those who initiate tobacco/alcohol use with respect to the risk of advancing into marijuana.

Perhaps the most original finding of this study is that we are able to demonstrate that this effect is not reproduced in the case of *pasta base*: the risk perception regarding *pasta base* is relatively constant irrespective of the position of respondent in the sequence. A possible explanation is that *pasta base* use is associated with extremely destitute and at risk populations. On the other hand, marijuana initiation is associated with significantly increased exposure to cocaine offers (and *pasta base*) for these users, as compared to those who stopped at the legal drug stage. The gateway effect focus mainly on marijuana, either because it lessens the perception of risk about the next drug (cocaine, but not *pasta base*) or because it leads to further consumption opportunities through a greater exposure to drug offers such as cocaine/*pasta base*.

References

- Agrawal, A., Neale, M. C., Prescott, C. A. & Kendler, K. S. (2004). A twin study of early cannabis use and subsequent use and abuse/dependence of other illicit drugs. *Psychological Medicine*, 34(7), 1227–1237.
- Bretteville-Jensen, A. L., Melberg, H. O., & Jones, A. M. (2005). *Sequential patterns of drug use initiation: Can we believe in the gateway theory?* York, UK: Health, Econometrics, and Data Group, University of York. Retrieved April 11, 2011, from http://www.york.ac.uk/res/herc/documents/wp/05_09.pdf
- Degenhart, L., Hall, W., & Lanskey, M. (2001). The relationship between cannabis use and other substance use in the general population. *Drug and Alcohol Dependence*, 64(3), 319–327.
- Fergusson, D. M., Boden, J. M. & Horwood, L. J. (2006). Cannabis use and other illicit drug use: testing the cannabis gateway hypothesis. *Addiction*, 101(4), 556–569.
- Golub, A., & Johnson, B. D. (1994). The shifting importance of alcohol and marijuana as gateway substances among serious drug abusers. *Journal of Studies on Alcohol*, 55(5), 607–614.
- Golub, A., & Johnson, B. D. (2002). Substance use progression and hard drug use in inner-city New York. In D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. 90–112). New York: Cambridge University Press.
- Hall, W., & Pacula, R. L. (2003). Is cannabis a gateway drug? In W. Hall and R. L. Pacula (Eds.), *Cannabis use and dependence: Public health and public policy* (pp. 104–114). New York: Cambridge University Press.
- Hawkins, J. D., Hill, K. G., Guo, J., & Battin-Pearson, S. R. (2002). Substance use norms and transitions in substance use: Implications for the gateway hypothesis. In D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. 42–64). New York: Cambridge University Press.
- Kandel, D. (1975). Stages in adolescent involvement in drug use. *Science*, 190(4217), 912–914.
- Kandel, D. B. (1978). Convergences in prospective longitudinal surveys of drug use in normal populations. In D. B. Kandel (Ed.), *Longitudinal research on drug use: Empirical findings and methodological issues* (pp. 3–38). New York: John Wiley & Sons.
- Kandel, D. B. (2002). Examining the gateway hypothesis: Stages and pathways of drug involvement. In D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. 3–15). New York: Cambridge University Press.
- Kandel, D. B., Yamaguchi, K., & Chen, K. (1992). Stages of progression in drug involvement from adolescence to adulthood: Further evidence for the gateway theory. *Journal of Studies on Alcohol*, 53(5), 447–457.
- Kandel, D. B., & Yamaguchi, K. (2002). Stages of drug involvement in the U.S. population. In D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. 65–89). New York: Cambridge University Press.
- Leshner, A. I. (2002). Foreword. In D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. xiii–xiv). New York: Cambridge University Press.
- Labouvie, E., & White, H. R. (2002). Drug sequences, age of onset, and use trajectories as predictors of drug abuse/dependence in young adulthood. In D. B. Kandel (Ed.), *Stages and pathways of drug involvement: Examining the gateway hypothesis* (pp. 19–41). New York: Cambridge University Press.
- Lynskey, M. T., Heath, A. C., Bucholz, K. K., Slutske, W. S., Madden, P. A., Nelson, E. C., et al. (2003). Escalation of drug use in early-onset cannabis users vs. co-twin controls. *JAMA*, 289(4), 427–433.
- Lynskey, M. T., Vink, J. M., & Boomsma, D. I. (2006). Early onset cannabis use and progression to other drug use in a sample of Dutch twins. *Behavior Genetics*, 36(2), 195–200.
- Mackesy-Amiti, M. E., Fendrich, M., & Goldstein, P. J. (1997). Sequence of drug use among serious drug users: Typical vs atypical progression. *Drug and Alcohol Dependence*, 45(3), 185–196.
- Naciones Unidas Oficina contra la Droga y el Delito (ONUDD). (2008). *Elementos orientadores para las políticas públicas sobre drogas en la subregión: Primer estudio comparativo sobre consumo de drogas y factores asociados en población de 15 a 64 años*. Lima, Perú.
- Newcomb, M. D., & Bentler, P. M. (1986). Frequency and sequence of drug use: A longitudinal study from early adolescence to young adulthood. *Journal of Drug Education*, 16(2), 101–120.
- Pedersen, W., & Skrandal, A. (1998). Alcohol consumption debut: Predictors and consequences. *Journal of Studies on Alcohol*, 59(1), 32–42.
- United Nations Office on Drugs and Crime (2010). *World Drug Report 2010*. Vienna, Austria.
- Van Ours, J. C. (2003). Is cannabis a stepping-stone for cocaine? *Journal of Health Economics* 22(4), 539–554.