RADICAL STATISTICS ESSAY COMPETITION 2014

FIRST PLACE: STUDENT COMPETITION

On the gateway hypothesis

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Drug policy has become one of the most hotly debated policy topics worldwide. Since 1960s, the policy view imposed at the international conventions is one of the "War on Drug" rhetoric, with a prominent role of the United States in the process. The development of this approach was a direct response to the growth of a youth counterculture of the mid-to-late 1960s in that country, which involved the use of illegal drugs. Its theoretical and philosophical bases can be traced down to the "spirals of decline" notion and the Broken Windows theory, corner stone of the "law and order" approach to penal policy. From this view, the law is seen as a tool for a 'remoralization' of society, as a means for fighting against crime. The notion of spirals of decline tended to blur distinctions between drugs and types of uses, and made the eradication of illegal drug consumption its main focus: "just say no", was the philosophy behind. Regarding marijuana more specifically, and given the relative subtlety of marijuana's direct health and coexistence harms to users and the wider community, was the idea of cannabis as a gateway or "stepping stone" drug that served as a major rationale for sustaining (or escalating) its prohibition (MacCoun and Reuter 2001). Thus, "legalising marihuana would simply encourage more and more of our young people

to start down the long dismal road that leads to hard drugs and eventually self-destruction." (Nixon 1971)

Although virtually every country in the world prohibit the consumption and sale of the same drugs that are prohibited in the United States, as required by the various international conventions, they have gone about implementing those prohibitions in quite varied ways (MacCoun and Reuter 2001). Moreover, Western Europe is the original home of the Harm Reduction movement, although Canada and Australia also became important reference points for this approach. Conversely to abstensionism, which prioritises the aim of decreasing the prevalence or incidence of drug use, Harm Reduction developed as a social policy which prioritizes the aim of decreasing the negative effects of drug use[1]. Furthermore, harm reduction acknowledges that different type of harms can result from drug use (health, social and economic), and at different levels (individual, community and societal). Lastly, recognizes that harm results not only from drug misuse itself, but also potentially from measures taken to combat it (Newcombe 1992). The Dutch experience of cannabis "coffee shops"2, since 1980s, was framed as a Harm and Risks reduction initiative that attempts to break the marginalisation of drug users and the conformation of deviant sub cultures, by separating cannabis from other illegal markets. Theoretically, this implied a reformulation of the marijuana as a gateway drug for which the problem was not as much the drug itself as its illegal context (Cohen 1994).

In 2014, Uruguay -a small country in South America- itself is facing an unusual situation at the international level, becoming the first nation in the world to challenge mainstream policies and comprehensively

[1]It may be more accurate to speak of optimising consequences, which incorporates both reducing harm and increasing benefits. However, the very notion of beneficial effects of illicit psychoactive drug use appears to be universally rejected by drug policy makers (Newcombe 1992:3)

[2]The government employs an expediency principle, and has issued guide lines on the use of discretionary powers, assigning the lowest judicial priority to the investigation and prosecution of cannabis for personal use. The guidelines further specify the terms and conditions for the sale of cannabis in authorized coffeeshops, whereby the sale of up to 5 grams of cannabis per transaction is tolerated and the coffeeshop is permitted to hold up to 500 grams of the drug (Bewley-Taylor et al 2014:50).

regulate the cannabis market[3], following similar local initiatives in Washington and Colorado, in the United States. During the parliamentary debate of the marijuana market regulation bill in Uruguay, the gateway hypothesis was one of the main topics embraced for both to support and to criticise the law. On one hand, arguing against the initiative, it was stated that "the 98% of the youth in drug use rehabilitation centres have had started using marijuana" (Redaccion 180 2013). On the other hand, supporters of the law argued that "98% of marijuana users never tried other illegal drug" and that "in any case, the fact that a temporal sequence exists does not mean that a cause effect relation is at place. Every young person that used free base cocaine had used marijuana before... It may be true, but before marijuana they had also consumed coca cola and milk..." (Redaccion 180 2013).

Based on the specialised literature on the subject and the Fifth National Drug Use Household Survey from the Uruguayan National Drugs Observatory[4] (from now on V NDUHS), the main objective of this article is to discuss the theoretical and empirical underpinnings of the gateway hypothesis, the issues involved in the definition of the key variables at play, and the implications for evidence based policy making.

The idea of marijuana as a gateway or "stepping stone" drug, comes from the observation of stages in drug consumption trajectories, where people who had used drugs at a particular stage had usually also used drugs at preceding stage(s) (Kandel 1978). However, while the existence of an empirical association between the order of "first tried" drugs in the

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[3]This innovative law not only authorizes domestic cannabis cultivation and the creation of cannabis membership clubs, but also tasks the state with overseeing the drug's production, distribution and sale.

[4]In Uruguay, the National Drugs Observatory -a technical independent agency in the orbit of the Executive Power- is the most important source of data available. Together with the National Survey of Secondary Students, the National Drug Use Household Survey (from now on V NDUHS) is the only systematic attempt to gather valuable information for the drug policy making in the country. While the first one is focused in a population of people attending public and private basic schools, the last one focuses on the residents of cities above 10000 inhabitants, from 15 to 65 years old, across Uruguay. The last Survey available is from 2011, and all the analysis presented in this essay are based on this data. A random and geographical multi stage sample of 5000 cases was constructed, with national representativeness of a population of 1:541.837. The sample error is +/- 1.41% for estimations at a 95% confidence level. The data is weighted by sex and age. The administration method of the survey is a face-to-face questionnaire.

life of people who use different legal and illegal substances is more or less widely accepted (as well as the fact that the first tried drug is almost always alcohol), a serious epistemological debate remains regarding the particular links between these events. Furthermore, if any causal relation does exists, a better comprehension of the nature of the distinctive mechanisms involved is vital for the policy making process.

A first issue for the evaluation of the gateway hypothesis regards the definition of the *dependent* variable of interest. The first and simplest version of the hypothesis links a set of independent variables with the use of other illegal drugs, besides cannabis, "at least once" in life, based on the "current practice in epidemiological drug studies" (Kandel et al 1978:19). Other authors, such as Cohen and Sas (1997), have argued that from a policy perspective, lifetime prevalence figures are not as important as regular, heavy, or even more specifically problematic drug use; whereas isolated experiences with drugs are more easily defined as a private act, only the former might justify a public health concern.

A second issue is if we should define the dependent variable as the use (beyond its frequency) of any other drug, only illegal drugs, or only certain types of illegal drugs, since the interaction between marijuana and each of these substances surely will not be the same and, depending on the context, they can interact either as complementary or substitute goods (Lucas 2012).

An additional set of difficulties regards the definition of the *independent* variables. Generally, this is the weakest side of the available official data, as the one used in this article, where the lack of experimental or quasi experimental research designs as well as meaningful control variables, threaten the validity of the associations explored. In a cornerstone study on the subject, Kandel et al (1978) tested the influence of four clusters of predictor variables: parental influences, peer influences, adolescent involvement in various behaviours, and adolescent beliefs and values. It was concluded that "parental factors, feelings of depression, and contact with drug-using peers are most important for [the use of] other illicit drugs than marijuana" (Kandel et al 1978:15).

Finally, a third type of challenge relates to the nature of the link between variables. The understanding of the causal mechanisms underpinning this relationship is not only of technical interest but also -and more importantly- of political importance as it determines what kind of policies are appropriate to address the issue. To go further into the empirical exploration of drugs use evolution would imply time ordered causal claims of the differential stages and use patterns for which longitudinal research designs are necessary and hardly available.

Given the limits of the existent data, the strategy selected is to offer different ways in which the gateway notion can be empirically approached. Following MacCoun and Reuter (2001:345-351), in the next section we will look into five different versions of the link between marijuana and other illegal drugs use.

The first step

If we look at the mean age at which "first tried" drugs, there is an order for the different substances, with a gap between alcohol, with a mean of 17 years old and the rest of the illegal drugs, starting from marijuana.

Ages of first use for different drugs

At what age did you use for the first time...?	N	Mean
Alcohol	1,361,498	16.62
Marijuana	306,992	18.30
Free base cocaine	17,546	18.91
Cocaine	95,343	18.95
Hallucinogens (such as LSD, Peyote or San Pedro, PCP, mescaline)	34,986	18.97
Ecstasy	22,927	20.46
Valid N (listwise)	2,163	

Source: V NDUHS

Additionally, if we look at the conditional probabilities, there is a higher chance of having used other illegal drugs among those who have also used cannabis at least once, than among those who did not.

Cross-tabulation of lifetime marijuana and other illegal drug use "at least once" (%)

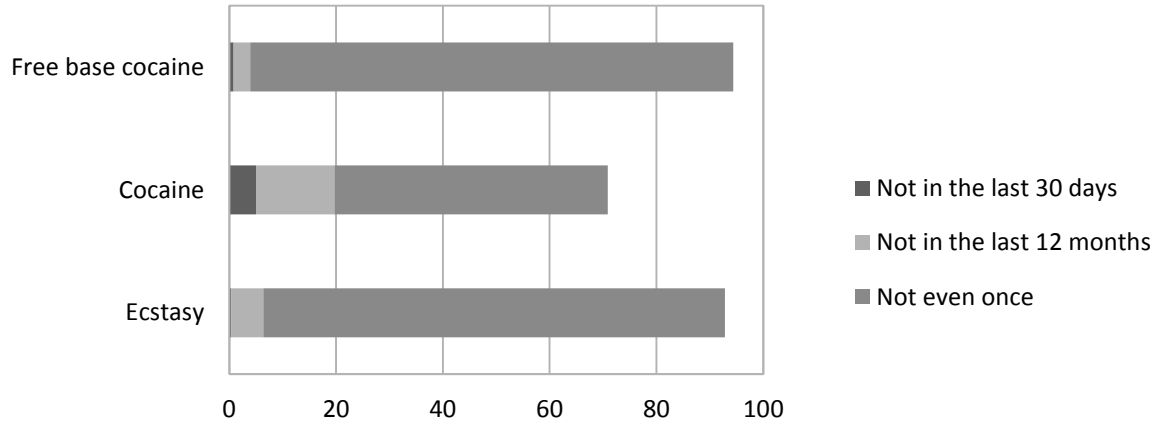
		Tobacco		Alcohol		Ecstasy		Hallucin-ogens		Cocaine		Free base cocaine		Total
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Marijuana	Yes	83.8	16.2	99.2	0.8	7.2	92.8	11.4	88.6	29.1	70.9	5.6	94.4	100 (n=307769)
	No	50.7	49.3	90.7	9.3	0.1	99.9	0	100	0.5	99.5	0	100	100 (n=1234068

Source: V NDUHS

The early warning signal

These observations point to marijuana as a signal of a population, reliably preceding and predicting the use of other illegal drugs. However, as MacCoun and Reuter stated, this "diagnostic value is limited. As a signal, cannabis mostly generates false alarms. The majority of cannabis triers never try harder drugs, and of those who do, few become regular users, much less addicts" (MacCoun and Reuter 2001:347). If we look at the discontinuation rates of drug use proposed by Cohen and Sas[5] (1997) we would see that discontinuation is the rule rather than the exception; only 0.3% of the 307769 people that used cannabis at least once had used ecstasy, 4.3% cocaine, and 0.8% free base cocaine in the last 30 days.

Discontinuation rates of hard drugs use among people who used cannabis at least once in their life (%)



Source: V NDUHS

The spurious correlation

A third way of approaching the relation between marijuana and other illegal drug use is trying to include other relevant factors that might be acting as confounders in the link. This is probably the most important constrain of using the available data: there are few and week control variables surveyed. The ones included in the analysis are: age, sex,

[5]The discontinuation rate of a drug is defined as the percentage of persons that report life time prevalence of a drug but do not report the use of that drug during the 12 months prior to interview, or during the last 30 days prior to interview (Cohen and Sas 1997:12).

residence area[6], if had visited a mental health specialist in the last 12 months, education level and marijuana use. Thus, the logistic regressions presented below are, in the best case, an interesting but limited methodological exercise: the results cannot be generalized in the sense of trying to state that the variables included in the models are the only relevant conditioner of illegal drug use other than marijuana.

The variable of interest to be explained is the probability for a person to have tried at least once cocaine, free base cocaine or ecstasy in the last 12 months. The selection of the independent variables was based in the exploratory association analysis presented earlier and the literature references. Specifically, it is that if you are a man, live in Montevideo, have a higher education level, have visited a mental health professional, and have tried cannabis, it will increase the chances of having tried other drugs in the last 12 months. Regarding age, we would expect a negative effect because of the concentration of illegal drugs use in the last 12 months in the younger generations -unlike the probability of having tried them at least once in life. The strategy selected is to present two different regression models to evaluate the pertinence of introducing some specification in the type of cannabis use to predict the use of other illegal drugs as in the survey people was asked if they have use marijuana during the last 12 months and how frequently.

FIRST Model

After including the independent variables selected, as they all were statistically significant, the predictability of the model increased. All other things being equal, the likelihood of having tried cocaine, free base cocaine or ecstasy in the last 12 months is slightly reduced by age, but increased by 20% if you are man, by 3% if you live in Montevideo and by 15% if you have visited a mental health professional within the same period. Surprisingly, the likelihood slightly decreased with the education level. Finally, having tried marijuana at least once increased the likelihood by almost 50%.

As it was already mentioned, there are several variables that might be acting as confounders in the relation in this relationship, such as parental factors and contact with drug-using peers, among others. And the high Nagelkerke R Square might be an indicator of endogeneity in the relation. Furthermore, the commonality of some experience with cannabis among youth in general, and those who have used other illegal

[6]Uruguay has 3.000.000 of inhabitants; approximately half of them live in Montevideo, the capital.

drug in particular, point to the fact that having tried marijuana at least once might be a trivial true, more akin to having tried alcohol.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	214242.895[a]	.069	.362

a. Estimation terminated at iteration number 10 because parameter estimates changed by less than .001.
n = 33652

Source: V NDUHS

Variables included in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Age	-0.05	.001	4958.137	1	.000	.953
	Sex	.854	.014	3976.677	1	.000	2.349
	Area	.157	.014	128.395	1	.000	1.170
	Education	-.109	.003	1111.498	1	.000	.897
	Mental health	.620	.015	1650.439	1	.000	1.859
	Marijuana at least once	4.347	.029	22571.517	1	.000	77.268
	Constant	-5.443	.038	20822.963	1	.000	.004

SECOND Model

The second model presented holds the same independent variables, but introduces a magnitude of marijuana use frequency in the last 12 months, instead of just have tried it at least once. The Nagelkerke R Square is now of .136, and the increased -2LL indicates that the fitting of the model is somewhat poorer. The main differences with the first model are that all the variables that remain significant show a stronger association than before. However, education and marijuana use frequency in the last 12 months are not statistically significantly different to 0 at a 95% confidence level.

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	283410.684[a]	.026	.136

a. Estimation terminated at iteration number 8 because parameter estimates changed by less than .001.

n = 33652

Source: V NDUHS

Variables included in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	Age	-.067	.001	16229.055	1	.000	.935
	Sex	1.291	.013	9822.049	1	.000	3.636
	Area	.903	.013	4696.662	1	.000	2.466
	education	-.006	.003	3.485	1	.062	.994
	Mental health	.783	.014	2931.678	1	.000	2.188
	Marijuana frequency	.018	.008	5.508	1	.019	1.018
	Constant	-3.171	.023	18659.202	1	.000	.042

The toe in the water

In this version of the link, seemingly safe experiences with marijuana might reduce the health and legal perceived riskiness of harder drugs. For example, there might be a displacement effect from marijuana to other drugs, if one's experiences fail to confirm the dire predictions of prevention programs.

In the Uruguayan survey, people were asked what was the risk related to the consumption of illegal drugs once or twice and occasionally. Among those who have tried marijuana at least once, the risk perception is lower than for those who have never tried it. Additionally, this last group presented higher rates of “don't know” responses. These differences are low (Phi values for cocaine=.316; free base cocaine=0.62 and ecstasy=.271), and statistically significant (Pearson Chi-Square=.000) in the three cases. Interestingly enough, these differences are lower, though still statistically significant for more frequent uses.

Risk of consuming cocaine once or twice						
		Noun risk	**Mild risk**	**Moderated risk**	**Big risk**	**I don't know**
Marijuana use	**Yes**	23.8	23.9	23.8	25.3	3.3
	No	5.8	13.4	18.9	54.6	7.2

N = 1541837

Source: V NDUHS

Risk of consuming free base cocaine once or twice						
		Noun risk	**Mild risk**	**Moderated risk**	**Big risk**	**I don't know**
Marijuana use	**Yes**	4.5	10.1	14.5	68.3	2.7
	No	1.9	5.3	9.4	78.9	4.5

N = 1541837

Source: V NDUHS

Risk of consuming ecstasy once or twice						
		Noun risk	**Mild risk**	**Moderated risk**	**Big risk**	**I don't know**
Marijuana use	**Yes**	12.4	12.6	15	46	14
	No	1.9	5.5	9.3	68.1	15.2

N = 1541837

Source: V NDUHS

The foot in the door

The last type of link that will be reviewed is the “opportunity mechanism” through which cannabis experience might cause hard-drug experience indirectly by bringing experimenters into contact with hard-drugs sellers. This hypothesis was first proposed by Herman Cohen's (1972) and was one of the main arguments in persuading the Dutch coffee shops model, as well as the marijuana regulation law in Uruguay. According to the V NDUHS, people who have used marijuana at least once perceive a slightly but statistically significant easier access to cocaine (Phi=.228) and free base cocaine (Phi=.134) than people who have not used it (Pearson Chi-Square=.000.)

How easy would be for you to have access to cocaine?					
		Easy	**Hard**	**I could not get it**	**I don't know**
Marijuana use	**Yes**	56.9	22.9	4.3	15.8
	No	32.5	21.5	8.1	37.9

N = 1541837

Source: V NDUHS

How easy would be for you to have access to free base cocaine?					
		Easy	**Hard**	**I could not get it**	**I don't know**
Marijuana use	**Yes**	52.8	19.2	8	19.9
	No	38.8	18.6	8.3	34.3

N = 1541837

Source: V NDUHS

How easy would be for you to have access to ecstasy?					
		Easy	**Hard**	**I could not get it**	**I don't know**
Marijuana use	**Yes**	19.4	35.8	9.6	35.2
	No	18.3	23.7	10.6	47.4

N = 1541837

Source: V NDUHS

Conclusions

This article tried to be a humble contribution to highlight the importance of moving beyond the mere correlation analysis of variables, grasping the theoretical foundations and mechanisms involved in the phenomena of interest. It also tried to illustrate how, in many cases, "evidence" is not a neutral and straightforward concept; conversely, multiple interpretations of the same data can coexist, being all of them technically pertinent.

Regarding the gateway notion, the discontinuation rates of drug use presented point to the fact that, for most of the people, drug use is a limited and relatively unproblematic experience in life. Thus the importance of overcoming rough generalisations, analysing further the particular ways in which distinct drugs use evolve through the life of people and the biological, structural and contextual factors that explain these differences.

Lastly, the "toe in the water" hypothesis suggests the importance of the "credibility factor" for the success of educational programs. Furthermore, questions the idea that the only way of not giving the "wrong message" to people, is the exclusive emphasis on the "just say no" to drugs.

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