The impact of ICT on adolescent's perception and consumption of substances.

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Abstract[*]

We conducted a three month randomized controlled trial to estimate the impact of an Internet and SMS based intervention on adolescents' information about substances and rates of consumption. A low percentage of participants logged into the web-platform but most participants were reached through e-mails and SMS. We found that the intervention was able to affect the awareness that certain substances are drugs but we did not find significant changes in consumption habits.

JEL classifications: I1, O31, C93
Keywords: randomized trial, drugs, smoking, alcohol

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1. Introduction

Due to biological and psychosocial factors, adolescence is a stage during which individuals are particularly vulnerable to the risks of substance use and abuse (Steinberg, 2007). In Uruguay, the rates of adolescent substance use are high when compared to those in other countries (CICAD/OEA 2006). A 2007 survey of Uruguayan students enrolled in Secondary Education showed that 70 percent had experimented with alcohol by the age of 13 and almost all students had consumed alcohol at least once by the age of 17. The rate of alcohol use in the past 30 days was 33 percent for students in the second grade of secondary school, 61 percent for students in the fourth year, and 75 percent for those in the sixth year. Around half of these students reported drinking to intoxication or binge drinking in the past 30 days. With respect to other drugs, 25 percent reported using tobacco in the past 30 days, 6 percent reported using marijuana in the past 30 days and 9 percent reported consuming marijuana in the past year (Junta Nacional de Drogas, 2006).

Adolescents' fast and early adoption of new information technologies creates important opportunities for engaging youths in preventive services via e-Health. The Internet and other information and communication technologies (ICTs) such as mobile phone short-message service (SMS) constitute cost-effective vehicles to access youth in a widespread manner, and they create opportunities for the use of interactive technologies that can increase students' skills and information assimilation (Marsch, Bickel and Badger, 2006). A number of preventive substance use interventions, for instance, have been introduced in developed countries through the Internet with relative success (Marsch, Bickel and Badger, 2006; Pahwa and Schoech, 2008; Bosworth, Gustafson and Hawkins, 1994). While there is little evidence of success of similar programs in less developed countries (Kaplan, 2006), the potential of e-Health preventive efforts in Uruguay acquires a special dimension when considering the recent introduction of a national education plan aimed at providing each student in the country with a laptop computer with Internet access (Plan Ceibal, "One Laptop per Child"). By the end of 2010 all students in Uruguay's public elementary schools as well as all students enrolled in the first year of public secondary schools are expected to have a laptop.

Considering the potential of ICT based interventions for youth, in this paper we use a randomized controlled trial to assess the impact of an Internet and SMS-based

intervention on adolescents' substance use behavior and perceptions regarding drugs. Participants include adolescents enrolled in third and fourth grade at 10 private secondary schools in Montevideo, Uruguay.

2. Background and Significance

A number of studies for developed countries have explored adolescents' perceptions and experiences of using the Internet to find information about health and medicines (Gray et al., 2005; Borzekowski and Rickert, 2001a; Skinner et al., 2003). These studies show that the Internet is the primary general information source for adolescents, regardless of their socioeconomic and ethnic backgrounds, and that most health information is accessed through search engines with a high success rate.

In terms of topics investigated, Skinner et al. (2003) found that Canadian adolescents used information technology for school-related reasons in the first place, followed by interactions with friends, social concerns, specific medical conditions, body image and nutrition, violence and personal safety, and sexual health. Another study by Borzekowski and Rickert (2001b) reported that sexually transmitted diseases, diet, fitness, and exercise, and sexual behaviors were the health-related topics most sought by adolescents on the Internet.

There are critical challenges associated with adolescents' search for information on the Internet. A number of authors indicate that adolescents lack the ability to discern the relevance of information retrieved by search engines and do not know which sites to trust (Gray et al., 2005; Hansen et al., 2003; Skinner et al., 2003). Adolescents do not consider the source of the content when searching for health information and scan web pages randomly rather than systematically. Other challenges involve adolescents' ability to apply identified health information to their own personal health concerns and the need for privacy in accessing information technology.

Inequality in access has also been identified as a serious barrier to the success of e-Health programs. Koivusilta, Lintonen and Rimpelä (2007) reported that computer use was most frequent among adolescents whose parents had higher education or socioeconomic status, who came from nuclear families, and who continued studies after compulsory education. In addition to disparities in access to ICTs at home, access issues are deepened if

there are insufficient school computers or computers that are unable to cope with increasing Web site sophistication. Software on school-based machines preventing exposure to material that is deemed to be unsuitable may also prohibit access to educational sites about sexual health and drug misuse (Gray et al., 2002).

Several programs suggest that a computer-based system may be a powerful tool for the reduction of risk-taking behavior by adolescents. Bosworth, Gustafson and Hawkins (1994) evaluated the effects of BARN (Body Awareness Resource Network), a computer-based health promotion/behavior change system that provided students (grades 6–12) with information and skill-building activities on AIDS, substance use, body management, sexuality, and stress management. During the two years that BARN use was studied, it was used heavily by both middle school and high school students, and particularly attracted adolescents who had already experimented with risk-taking behaviors. Those teens at higher risk for escalating problems selected the relevant BARN topics. Overall, users of BARN were more likely to remain free of risk-taking behaviors than nonusers of BARN. BARN use was also associated with improvements in risk-relevant behaviors such as contraceptive use, stress reduction, cessation of smoking by light smokers, reduction of alcohol use, and reduction of problems associated with alcohol use. No relationship was found between BARN use and initiation of sexual activity, stress prevention, or onset of either alcohol use or smoking.

De Nooijer et al. (2008) assessed the opinions of adolescents regarding an Internet-based health monitoring instrument and its individually tailored electronic feedback at a number of schools in The Netherlands. While the majority of students appreciated the Internet-based monitoring questionnaire and the individually tailored feedback, one out of three respondents claimed that the information was not new to them, and 40 percent indicated that the information failed to provide them with additional insight into their behavior. Recommendations for future interventions included: i) embedding monitoring and feedback in school curriculum, ii) providing immediate feedback and iii) adapting tailored messages to educational levels and age.

Using a randomized controlled trial, Croom et al. (2009) assessed the short-term effectiveness of a Web-based alcohol education program on entering freshmen. The intervention consisted of an online course prior to arrival to campus. At a six-week follow-

up, the intervention group showed significantly higher alcohol-related post-course knowledge compared to the control group. However, protective behavior, risk-related behavior, high-risk drinking, and alcohol-related harm did not favor the intervention group, with the sole exception of lower rates of playing drinking games.

Pahwa and Schoech (2008) evaluated an interactive multimedia anger management exercise that was part of a teen substance abuse prevention website. They found that a 30-minute exposure to a web-guided prevention exercise could increase teens' prevention knowledge and that completing the online exercise as supplemental homework reinforced the classroom experience. However, positive changes in other measures of behavior change were not supported.

Marsch, Bickel and Badger (2006) report findings of a controlled evaluation of "Head On: Substance Abuse Prevention for Grades 6-8TM." This program was designed to deliver drug abuse prevention tools to youth via computer-based educational technologies (fluency-building computer-assisted instruction and simulation-based technology) that promote learning of information and drug refusal skills, self-efficacy and social competency. Results demonstrated that the Head On program promoted significantly higher levels of accuracy in objective knowledge about drug abuse prevention relative to other effective programs. Participants in the "Head On" also achieved positive outcomes in self-reported rates of substance use, intentions to use substances, attitudes toward substances, beliefs about prevalence of substance use among both their peers and adults, and likelihood of refusing a drug offer. The Head On program offers the potential of providing comprehensive substance abuse prevention science that is more cost-effective than other efficacious but labor-intensive prevention interventions.

Participation is quite a challenge in programs targeted at preventing adolescent substance use. Some of the programs described above were implemented mandatorily, ensuring high rates of participation from adolescents. The modules in Head On were delivered as part of the school curriculum (Marsch, Bickel and Badger, 2006). The Web-based alcohol online education program described in Croom et al. (2009) was required from entering freshmen prior to arrival to campus. Other programs such as BARN (Bosworth, Gustafson and Hawkins, 1994) were voluntary but remained available on participating schools' computers for a long period (two years), and they included games and simulations

that helped attract teens to the system. During the period of the study, 67 percent of students in experimental schools interacted with BARN at least once, and BARN users came back an average of almost 18 times during the 14 months it was available. Other programs, such as the health monitoring instrument with tailored feedback implemented in Netherlands, could not assess the extent to which the feedback had reached the students because only 3 percent of these students returned a follow-up assessment of the feedback system.

Apart from the Internet, another vehicle with the potential for delivering successful health behavior interventions is mobile telephone short-message service (SMS). This service has wide population reach, can be individually tailored, and allows instant delivery with asynchronous receipt. In a review of the literature Fjeldsoe, Marshall and Miller (2009) found four studies targeted at preventive health behaviors and 10 focused on clinical care that used SMS to deliver text messages. Positive behavior change outcomes were observed in 13 out of the 14 reviewed studies. For example, Riley, Obermayer and Jean-Mary (2008) conducted a smoking cessation program using mobile phone text messaging to provide tailored and stage-specific messages to college smokers. The intervention reduced smoking rates and dependence, indicating that mobile phone text messaging is a potentially efficacious and easily disseminated method for providing cessation interventions for young adult smokers. Another study used mobile phone messages to send tailored information to obese adolescents enrolled in a multidisciplinary weight management program. Most adolescents found the messages relevant to them personally and reported that the messages helped them to keep focused (Woolford and Clark 2009).

3. Methods

3.1 Design Overview

A randomized controlled trial was conducted to evaluate an Internet and SMS-based intervention that provided adolescents with information about the risks and consequences of substance use. The object of the study was to analyze the effectiveness of the ICT intervention in terms of knowledge acquired by participants about drugs and their consequences, actual substance use, and related behavioral outcomes such as violence and

crime, sexual behavior, academic achievement, and health care utilization. The study underwent review by an ethics committee of Universidad ORT Uruguay.

3.2 Recruitment and Participants

The target population was composed of teenagers who were in their third or fourth year of secondary school. The majority of these students were between 14 and 16 years old. We chose to work only with students attending a selection of private schools in Montevideo because interventions in public schools usually require much longer and more complicated bureaucratic processes.[1] Compared to the average Uruguayan teenager, students who attend private secondary schools have a significantly higher socio-economic status. This could indicate higher access to PCs and Internet connections for our sample, although the One Laptop per Child initiative, currently being implemented in Uruguay, is likely to universalize PC and Internet use in Secondary Public Education in the near future.

Before initiating the study, all parents were sent informative letters by school authorities and were asked to provide their written consent regarding their children's participation. Students were repeatedly told that their participation in the survey and in the intervention, if selected, was completely voluntary and that they were free to leave the project at any stage.

A total of 10 schools agreed to participate in the project. A set of students was randomly selected to participate in the study, and the rest remained in a control group. Ideally, individuals in the control group should have on average the same characteristics as those in the treatment group but should not be affected by the intervention. We were concerned that if the randomization was performed at the individual level there could be contagion between treatment and control classmates. Therefore, participants were randomized into intervention and control groups not individually but by class within each grade and school. In general, school authorities confirmed that assignment of students to each class was random. We collected data on 1,044 students corresponding to 47 classes and selected 17 out of the 47 classes (359 students) for the intervention. We refer to these students as the group intended to be treated (ITT).

[1] In the public school system, interventions such as the one undertaken here public schools cannot be authorized directly by the school authority but must be approved by the National Administration of Public Education.

Each student was asked to complete two surveys, one at the baseline and the other three months after the project's completion. In these surveys, a variety of information was collected on drug consumption, knowledge about drugs, sexual activity, violence, leisure activities and socio-demographic topics. The first survey was the initial contact and the second survey the last contact that the project staff had with students. The surveys were self-administered by students at schools with the supervision and help of the research staff of Universidad ORT Uruguay and took around one hour to complete. During the second survey, around 206 interviews had to be conducted by phone due to scheduling problems. In the second survey 48 students refused to participate.

3.2 The Intervention

The intervention, which lasted 3 months (from September through November 2009), had several components designed to take advantage of the wide arrange of ICTs used regularly by adolescents. The first component consisted of the posting of adolescent-friendly information and materials related to drug consumption and abuse on a website named "COLOKT". The website, which was based on the widely popular Moodle platform, was specially designed and administered for this study by Evimed,[2] a private firm that develops information and educational products and services for physicians throughout Latin American. Information on the website was updated weekly. COLOKT offered valuable information on a variety of topics such as the relationship between adolescence and substance use, risks and problems associated with substance use, and the particular characteristics of the most popular drugs among Uruguayan adolescents. All participants in the intervention group with a valid email address (the majority of students) were given a unique nickname and password that gave them anonymous access to the website. These students were able to access the site unrestrictedly and could download all available material on the web.

Besides the educational material posted on COLOKT, the site offered the opportunity to meet in forums and chats, to complete short surveys on the topics, and to discuss ideas or ask about the materials or other topics related to substance use. This Internet-based social network component was aimed at generating discussion, questions

[2] http://www.evimed.net/

and knowledge exchange among participants. In order to stimulate and organize participation, the exchanges were moderated by an educator who was either a psychologist or a family physician with expertise on adolescents' substance use. Periodically, one of the educators commented on the issues discussed to clarify concepts or misconceptions on specific information. These comments were posted on the site and sent to all participants by email.

Before being granted access to COLOKT, adolescents in the intervention group attended an in-school workshop approximately two hours long. At the workshop, a brainstorming activity was proposed in which students posed questions and raised concerns about the use of substances. The object of this activity was to get a closer sense of adolescents' expectations and needs regarding this topic, but no answers or content were addressed in this instance. The workshop also provided a brief introduction to the project site COLOKT as well as instructions on how to log on and use the different resources available at the site. The workshops were offered at all schools participating in the study, although some students did not participate in them for reasons such as lack of parental authorization or scheduling problems.

In addition to the COLOKT site, intervention participants were reached through two other channels. First, all students received a series of emails from the project staff, announcing the addition of new materials at COLOKT or commenting on different issues raised by students during their participation in the web site. Second, a series of text messages was sent periodically to participants' cell-phones. These text messages also announced forthcoming activities at COLOKT and provided basic information about substance use and risks. During the three months of the intervention the project staff sent eight emails and seven SMS messages.

3.3 Levels of Participation

According to the information automatically collected by COLOKT, 74 students (21 percent of the ITT) logged on at least once during the experiment. Among this subgroup, 41 students (55 percent) logged on for one day, 13 students (18 percent) did so on two days, and the remaining 27 percent on three days or more. Most visitors simply took a look at the site and/or read posts or materials uploaded. Around 25 students (7 percent of the ITT)

showed a strong interest in the site and engaged in a variety of activities, such as forums, chats or online surveys.

There is some disagreement between the participation records stemming from the web logs and levels of participation as reported by the students in the second survey. Twenty-one students (6 percent) who according to automatic registers had logged on at least once did not remember having visited the site when asked about their participation in the follow-up survey. In addition, 45 students (12 percent) who according to our records did not log on reported having visited COLOKT. It is possible that some students visited the site's page for a few minutes and do not remember the visit. The other inconsistency may be due to some students having visited the website with other classmates without using their nickname. This would explain the failure to identify these visitors among the site records.

Despite this disagreement between our records and self-reports of participation, the data show that only a minority of those in the intervention group visited the project's website. Although this relatively low level of participation merits further research, we believe that the lack of interest in the topic, together with the unstructured and non-mandatory character of the intervention, were the main reasons for non-participation. In the second survey we asked all students who reported never logging on the reasons for not doing so. Students were offered several alternatives and could select as many choices as they wanted. Sixty-four percent declared that they did not log on because they were not interested in the topic, 12 percent reported that they preferred using other channels of information on drugs, 2 percent were not sure that their anonymity was guaranteed, 10 percent reported they were not frequent Internet users, and 2 percent stated that the site was not recommended by other classmates.

Although most students never visited COLOKT, most members in the "intention to treat" group were reached by the experiment via email messages and/or text messages. Around 75 percent of students reported having received text messages related to the project, and 68 percent reported having received emails from project staff (again, it is possible that some students received emails or text messages but did not remember them or simply considered them spam). Combining this information, 52 students (15 percent) never logged on at COLOKT and never received emails or text messages according to their self-reports.

On the other hand, the data indicate that 307 students (85 percent of the target population) were reached by the project's information and communication technologies in one way or another.

In sum, out of the 359 students originally selected to participate in the intervention (the randomized group of students we intended to treat), only 74 logged on to the COLOKT website according to the automated records in COLOKT. We refer to this group as the "Web +SMS Intervention" group. The rest of the a priori participants (N=285) did not access the web but should have received SMS and emails. We refer to this other group as the "SMS only Intervention."

4. Results

4.1 What Is a Drug?

The most basic piece of information is whether a particular substance is a drug or not. According to the World Health Organization (1969) a drug is any substance that when absorbed into the body of a living organism alters its normal bodily function. We analyze drugs that are considered recreational because their use pursues the creation or enhancement of recreational experiences through the manipulation of the central nervous system. Not all drugs necessarily cause addiction and habituation.

We gave the participants a list of 10 substances and asked them to assess which of these constituted drugs. The "correct" answer was that all 10 were drugs. As seen in Table 1, some substances were clearly perceived as drugs before the intervention. More than 9 out of 10 students, for example, considered cocaine, ecstasy, "pasta base" (a variation of crack cocaine) and marijuana to be drugs. Around 60 percent of participants rated anxiolytics, antidepressants, LSD and tobacco as drugs. But less than 50 percent of participants considered alcohol (of either high or low volume percentage) to be a drug. The perceptions were similar for individuals in the control group and those a priori selected to participate in the intervention. The following summary statistics are disaggregated between control students, intervention students who logged on to COLOKT (Web+SMS) and the rest of the selected participants who could only be reached by SMS or email (SMS only).

Table 1. Is It a Drug?
(Percentage of students stating that each of the following substances is a drug, baseline survey)

	Anxiolytics	*Antidepressants*	*Beer/Wine*	*Cocaine*	*Ecstasy*
Control	59.7%	65.1%	43.6%	98.4%	93.5%
SMS only	58.9%	66.1%	45.2%	99.6%	91.9%
Web+SMS	69.0%	73.2%	41.4%	100.0%	91.4%
Total	60.1%	65.9%	43.9%	98.9%	92.9%
N	976	975	975	986	980
	Whisky/Rum	*LSD*	*Marijuana*	*Pasta base*	*Tobacco*
Control	46.4%	75.5%	95.4%	98.6%	74.9%
SMS only	50.0%	79.2%	93.3%	99.0%	70.9%
Web+SMS	47.1%	63.4%	95.8%	98.6%	77.5%
Total	47.5%	75.7%	94.8%	98.7%	73.9%
Cases	977	978	987	990	978

The intervention provided information that altered the perceptions of what is a drug. Table 2 reports changes in responses to this question between the pre and post-intervention surveys. Most of the individuals in the control and "Intention to Treat groups" gave the same answer in both surveys but a sizeable proportion changed their answer. In the "right-wrong" row we report the percentages of participants that in the first survey considered the substance to be a drug but in the second survey asserted it was not a drug. The "wrong-right" row shows the opposite direction of change. For most drugs (except cocaine, marijuana and pasta base), the fraction of adolescents in the "wrong-right" row is higher than the percentage in the "right-wrong" row. This is observed both for adolescents in the intervention and in the control groups. The general better perception of what constitutes a drug might be the result of other formal or informal transfers of information (e.g., school workshops). Alternatively, these changes may be due to "seasonal" awareness. The first wave of the survey was conducted at the end of the winter in the middle of the school year, while the second wave was conducted at the end of spring in the last weeks of school. Participation in parties and exposure to substance consumption is very likely to be different between these two moments in time and may affect the perception of what is a drug. Another explanation is that the control group may have been contaminated by the ITT

students. While we do not have evidence of this contamination, we cannot rule it out, either.

If the intervention produced a real effect in the perception of what constitutes a drug, the difference between the "right-wrong" and "wrong-right" rows should be lower in the control than in the intention to treat group. This is the case for anxiolytics, low graduation alcohol like beer or wine, ecstasy, LSD, tobacco and marijuana.

Table 2. Is It a Drug?
(Changes in answers between the first and second surveys)

	Anxiolytics				*Antidepressants*			
	Control	*SMS only*	*Web+SMS*	*Total*	Control	SMS only	Web+SMS	Total
Right-Wrong	*12%*	*12%*	*8%*	*12%*	10%	12%	10%	10%
Same answer	*73%*	*71%*	*79%*	*73%*	76%	71%	75%	75%
Wrong-Right	*14%*	*17%*	*13%*	*15%*	14%	16%	15%	15%
Cases	*625*	*280*	*71*	*976*	624	280	71	975
	Beer or wine				*Cocaine*			
	Control	*SMS only*	*Web+SMS*	*Total*	Control	SMS only	Web+SMS	Total
Right-Wrong	*10%*	*10%*	*7%*	*10%*	2%	1%	0%	2%
Same answer	*73%*	*70%*	*69%*	*72%*	96%	99%	100%	97%
Wrong-Right	*17%*	*20%*	*24%*	*18%*	1%	0%	0%	1%
Cases	*624*	*281*	*70*	*975*	631	284	71	986
	Ecstasy				*Whisky/ron*			
	Control	*SMS only*	*Web+SMS*	*Total*	Control	SMS only	Web+SMS	Total
Right-Wrong	*4%*	*2%*	*1%*	*3%*	9%	11%	7%	9%
Same answer	*91%*	*93%*	*93%*	*92%*	72%	70%	73%	72%
Wrong-Right	*5%*	*6%*	*6%*	*5%*	19%	19%	20%	19%
Cases	*627*	*283*	*70*	*980*	627	280	70	977
	LSD				*Marijuana*			
	Control	*SMS only*	*Web+SMS*	*Total*	Control	SMS only	Web+SMS	Total
Right-Wrong	*6%*	*3%*	*3%*	*5%*	5%	2%	4%	4%
Same answer	*77%*	*81%*	*69%*	*78%*	92%	94%	94%	93%
Wrong-Right	*17%*	*16%*	*28%*	*18%*	3%	5%	1%	3%
Cases	*624*	*283*	*71*	*978*	632	284	71	987

	Pasta base				*Tobacco*			
	Control	*SMS only*	*Web+SMS*	*Total*	Control	SMS only	Web+SMS	Total
Right-Wrong	*2%*	*1%*	*0%*	*2%*	12%	9%	4%	10%
Same answer	*97%*	*98%*	*99%*	*97%*	76%	75%	82%	76%
Wrong-Right	*1%*	*1%*	*1%*	*1%*	13%	17%	14%	14%
Cases	*633*	*286*	*71*	*990*	625	282	71	978

In order to provide a more rigorous estimation we use the "difference-in-difference" framework (Card, 1992; Gruber 1994), This involves a simple comparison between the control and ITT groups of changes in perceptions about drugs before and after the intervention. Note that our main indicator of exposure to the intervention is not the real ex post exposure (as captured by the Web+SMS or SMS only groupings), but the a priori ITT group. This variable is completely exogeneous due to randomization, and by using it we ensure that our results are not biased by selection in participation. Estimation is implemented by pooling observations in both surveys and estimating a probit regression of the form

$$\Pr(Y_i = 1) = f(\beta_0 + \beta_1 ITT_i + \beta_2 Wave_{2i} + \beta_3 ITT_i * Wave_{2i} + \varepsilon_i)$$

where Y_i, ITT_i and $Wave_{2i}$ are dummies. Y_i takes the value 1 if the *i*-student asserted that a certain substance was a drug, ITT_i takes the value 1 if the *i*-student was in the ITT group (i.e. he was in a class that was selected to participate in the intervention) and $Wave_{2i}$ takes the value of 1 when the answer refers to the second survey. The coefficient multiplying ITT_i (β_1) reflects baseline differences between the intention to treat and control groups. The coefficient of $Wave_{2i}$ (β_2) reflects changes in answers due to the passing of time. The effect of the intervention is captured by the interaction term.

In Table 3 we report the estimation of the difference-in-difference model where we cluster standard errors at the school level. This is to relax the usual assumption that observations are independent. Instead, we assume that observations are independent across schools (clusters) but not necessarily within schools.

According to our results, the intervention improved students' perceptions of what constitutes a drug in four cases (ecstasy, LSD, marijuana and tobacco) and had no

significant effects in the other six. In the case of pasta base and cocaine, the perceptions were already high. However, the intervention did not change perceptions about alcohol as a drug or anxiolytics and antidepressants. The unconditional probability that a participant in the study asserts that ecstasy, LSD, marijuana and tobacco are drugs is 94.0 percent, 83.1 percent, 94.6 percent and 75.9 percent, respectively. In some cases the unconditional probability is close to 100 percent, and therefore the room for improvement is small. The marginal effects of the intervention on drug perception (the changes in the probability of perceiving the substance as a drug) were 2.5 percent, 6.0 percent, 3.0 percent and 7.1 percent respectively for ecstasy, LSD, marijuana and tobacco.

It is interesting to note from Table 2 that the individuals in the ITT who did not participate in the web platform actually performed better than those who participated in the web platform with respect to the two drugs where we find the larger effects: tobacco and marijuana. If we had to evaluate the intervention in terms of this single question only, an SMS intervention would probably be more cost-effective than a web-based intervention.

Table 3. The Impact of the Intervention in Adequately Perceiving Substances as Drugs
(Difference-in-difference model)

	Anxiolytics	*Antidepressants*	*Beer/Wine*	*Cocaine*	*Ecstasy*
ITT	0.033	0.067	0.022	1.1.1 0.620	1.1.2 -0.120
	(0.092)	(0.138)	(0.098)	(0.388)	(0.074)
Wave2	0.058	0.134	0.181	-0.194	0.094
	(0.075)	(0.050)***	(0.077)**	(0.107)*	(0.116)
ITTxWave2	0.071	-0.003	0.098	-0.040	0.238
	(0.110)	(0.095)	(0.137)	(0.454)	(0.129)*
Constant	0.245	0.387	-0.161	2.148	1.511
	(0.060)***	(0.063)***	(0.122)	(0.109)***	(0.149)***
Observations	1952	1950	1950	1972	1960
	Whisky/Rum	*LSD*	*Marijuana*	*Pasta base*	*Tobacco*
ITT	0.076	0.016	-0.148	0.092	-0.081
	(0.062)	(0.111)	(0.088)*	(0.223)	(0.105)
Wave2	0.253	0.430	-0.171	-0.148	0.036
	(0.057)***	(0.134)***	(0.078)**	(0.201)	(0.075)
ITTxWave2	-0.036	0.256	0.327	0.148	0.243
	(0.078)	(0.083)***	(0.117)***	(0.318)	(0.114)**

Constant	-0.090	0.690	1.686	2.191	0.671
	(0.120)	(0.172)***	(0.124)***	(0.166)***	(0.094)***
Observations	1954	1956	1974	1980	1956
Clustered standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1					

3.4 Consumption

The pre and post intervention surveys had a detailed module on substance use. Table 4 presents the percentage of individuals who smoked or drank alcohol in the past 30 days and the percentage that consumed marijuana or cocaine. Rates of consumption for our sample are similar to those derived from a nationally representative survey of students in public and private secondary schools in 2007 (Junta Nacional de Drogas, 2006). Findings from this survey show a prevalence of current alcohol use (past 30 days) of 32.5 percent for students in the second grade of secondary school and of 61.3 percent for students in the fourth grade. Our estimates, corresponding to students enrolled in third and fourth grades, are in between (55 percent in Wave 1 and 50 percent in Wave 2). The national sample also showed tobacco consumption rates of consumption of tobacco of 14 percent and 31 percent for students in the second and fourth grade of secondary school, respectively. This plausibly encompasses our estimate of 20 percent for students in third and fourth grade.

We did not find statistically significant differences in rates of consumption between Waves 1 and 2 as a result of the intervention. We observed a decrease in the consumption of alcohol that could be associated with year-end final exams. On the other hand, we found an increase in the three-month prevalence of marijuana and cocaine. These changes are present in both the control and treatment groups. Table 5 reports the estimation of a difference-in-difference model that confirms that the intervention had no statistically significant effects on substance use.

Table 4. Percentage of Participants Who Consumed the Following Substances

	Cigarettes (last 30 days)		*Alcohol (last 30 days)*		*Marijuana (last 3 months)*		*Cocaine (last 3 months)*	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Control	18.0%	18.8%	54.1%	48.6%	10.0%	15.0%	0.3%	6.4%
SMS only	22.0%	22.3%	56.2%	53.3%	14.3%	17.0%	1.7%	5.7%
Web+SMS	20.3%	17.6%	51.4%	51.4%	12.2%	18.9%	1.4%	4.1%
Total	19.3%	19.7%	54.5%	50.1%	11.4%	15.9%	0.8%	6.0%
Cases	1,046	1,045	1,044	1,045	1,046	1,046	1,046	1,046

Table 5. Probability of Consuming Substances
(impact of intervention)

	Cigarettes (last 30 days)	*Alcohol (last 30 days)*	*Marijuana (last 3 months)*	*Cocaine (last 3 months)*
ITT	0.136	0.026	0.133	0.197
	(0.153)	(0.149)	(0.155)	(0.253)
Wave2	0.034	-0.142	-0.000	0.317
	(0.048)	(0.072)**	(0.055)	(0.249)
ITTxWave2	-0.043	0.082	0.014	-0.317
	(0.069)	(0.077)	(0.136)	(0.198)
Constant	-0.920	0.105	-1.285	-2.731
	(0.146)***	(0.117)	(0.153)***	(0.252)***
Observations	2,090	2,086	1,974	1,978
Clustered standard errors in parentheses				
* significant at 10%; ** significant at 5%; *** significant at 1%				

5. Conclusions

We found that the three-month intervention implemented was able to improve the information about drugs but induced no change in behavior. We found an increased awareness that ecstasy, LSD, marijuana and tobacco constitute drugs. The evidence also suggests no differences among those who logged on to the web platform and those who

only received emails and SMS. Therefore, in this intervention, the web platform was probably cost-inefficient.

We are not particularly surprised about the fact that the intervention had null effects on the actual substance use behavior of the ITT students, as the primary purpose of the intervention was to provide students with basic information on substance use and not to produce a significant change in their behavior. Also, we should recall that most students did not visit the project site but simply read a few emails or SMS messages. In sum, we think that changing student behavior needs a different approach that is not only informative but also involves students in more encompassing activities.

The fact that only a fifth of students visited the project's site also merits some comments. Based on the students' own reports, we think the low level of participation is explained primarily by such low level of participation is the lack of interest in the topic. Therefore, to ensure higher levels of participation in future experiments, there are two possibilities. One option is to implement mandatory interventions in which students need to log on a certain number of days per week, complete online surveys and participate in chats with the project educators. In this case, the intervention would be more like a school course where student participation could even be graded. Naturally, this type of intervention would require school authorities to participate much more actively in the intervention. The other option would be to create a web site that combines informative activities on drugs (like those offered by COLOKT) with leisure activities especially suited for the adolescent population such as the opportunity to video-chat with local music or TV stars, play online games or download music or TV series. Applications using state-of-the-art programming, such as video gaming or simulations, may also help reach this population.

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