



## Social rank and inhalant drug use: The case of lança perfume use in São Paulo, Brazil

Zila M. Sanchez<sup>a,\*</sup>, Ana R. Noto<sup>b</sup>, James C. Anthony<sup>c</sup>

<sup>a</sup> Department of Preventive Medicine, Universidade Federal de Sao Paulo, Rua Borges Lagoa, 1341, Sao Paulo 04038-034, Brazil

<sup>b</sup> Department of Psychobiology, Universidade Federal de Sao Paulo, Rua Napoleão de Barros, 1058, Sao Paulo 04024-002, Brazil

<sup>c</sup> Department of Epidemiology and Biostatistics, College of Human Medicine, Michigan State University, 909 Fee Road Room B601, East Lansing, MI 48824, USA

### ARTICLE INFO

#### Article history:

Received 9 August 2012

Received in revised form

16 November 2012

Accepted 3 December 2012

Available online 29 December 2012

#### Keywords:

Inhalants

Adolescents

Epidemiology

Brazil

School survey

### ABSTRACT

**Background:** Lança perfume (chloroform/ether) is an inhalant used mainly by higher social class students in Brazil. In light of the social and epidemiological features of lança use, supply, and distribution, this investigation tests hypotheses about the degree to which use of inhalant lança might be occurring in clusters, consistent with social sharing and diffusion, and might show a direct association with social rank even within the relatively privileged social context of private schools in a large mega-city of Latin America.

**Methods:** Epidemiologic self-report survey data were from a large representative sample of urban post-primary private school students in São Paulo city, Brazil, in 2008. Newly incident lança use was studied, first with estimates of clustering from the alternating logistic regressions (ALR) and then with conditional logistic regressions to probe into the hypothesized direct social rank association.

**Results:** ALR disclosed a clustering of newly incident lança users within private school classrooms (pair-wise odds ratio (PWOR) = 2.1; 95% CI = 1.3, 3.3;  $p = 0.002$ ) as well as clusters of recently active lança use (PWOR = 1.9; 95% CI = 1.1, 3.3;  $p = 0.02$ ). Occurrence of lança use within private school classrooms was directly associated with social rank (odds ratio (OR) = 0.2; 95% CI = 0.1, 0.8;  $p = 0.03$  in the contrast of lowest socio-economic status (SES) versus highest SES strata within classrooms). Thereafter, study of other drugs disclosed similar patterns.

**Conclusions:** The clustering estimates are consistent with concepts of person-to-person sharing of lança within private school classrooms as well as other dynamic processes that might promote lança clusters in this context. An observed direct association with social rank is not specific to lança use. Direct SES estimates across a broad profile of drug compounds suggests causal processes over and above the more specific initially hypothesized social rank gradients in the lança diffusion process. A novel facet of the evidence is greater occurrence of drug use among the higher social rank private school students, which should be of interest in the social science community.

© 2012 Elsevier Ireland Ltd. All rights reserved.

### 1. Introduction

In Brazil, traditionally a low income country that is now consolidating its upper middle-income rank (WorldBank, 2011), and in mega-city Sao Paulo, the medical and public health communities first became aware of 'lança' as a form of illegal drug use many years ago. 'Lança' is an inhalant drug known colloquially as 'lança perfume' or 'loló', trafficked largely in Brazil and Argentina, where its use is illegal (Mesquita et al., 1998). Chloroform and/or ether are primary constituent ingredients typically required to produce

this inhalant drug in small bottles or flasks, or in metal capsules manufactured for black market retail sale, often containing cereal ethanol and a candy besides the ether or chloroform formulation (often, ethyl chloride). In 2004, the Brazilian federal police seized 70,000 bottles of lança (Duarte et al., 2011). In this context, we note that inhalant drug use has been a generally neglected topic in the world literature of public health, although inhalant drug-taking has adverse consequences such as neurocognitive toxicities (Balster, 1997; Balster et al., 2009).

In epidemiological field surveys conducted during the past 30 years, there has been a general over-representation of higher social status individuals among lança users for reasons explained below (e.g., medical students in university). We note, however, that Carlini-Cotrim and Carlini (1988) found limited lança use among 9–18 year old low socio-economic status (SES) students as early as two decades ago.

\* Corresponding author at: Department of Preventive Medicine, Universidade Federal de Sao Paulo, Rua Borges Lagoa, 1341, 1º andar, São Paulo 04038-034, Brazil. Tel.: +55 11 55764876.

E-mail address: [zila.sanchez@gmail.com](mailto:zila.sanchez@gmail.com) (Z.M. Sanchez).

More recent studies in Brazil disclose noteworthy occurrence of lanca use among university students, including medical students, among whom an estimated 20–50% have tried it, with most of these students from higher SES strata (Carvalho et al., 2008). Lanca use also has been observed at the pre-university level. Among the younger students an estimated 10–15% have tried any inhalant drug, and an estimated 50% of the inhalant users have tried lanca (Carlini et al., 2011; Galduroz et al., 2005).

The published epidemiological studies of drug use point toward an eventual greater concentration of users among the lower social strata, with recent illustrations in field survey research on cocaine, although the base of evidence is largely from the United States and Europe [e.g., see Miech and Chilcoat, 2007]. Formulated with an appreciation of the supply and distribution of lanca products through peer groups and social networks in Brazil, our view that lanca use might be occurring at greater frequency among higher social status individuals in Brazil runs counter to this accumulated evidence.

The general over-representation of lanca use among medical and university students of higher social rank might be explained by the compound's nature, its supply and distribution chains, and its cost, as well as the general epidemiology of drug use in Brazil, where it seems that wealthier people are over-represented among users of all illegal drug types (Carlini et al., 2011). In this respect, early field inquiries about lanca identified epidemiological details of interest. First, unlike most inhalants, and until the very recent Internet sales, lanca has not been as widely available as other inhalants that tend to be ubiquitous in Brazilian households (e.g., glue and nail polish). Second, before recent Internet sales of commercially manufactured lanca, students at university or in medical schools produced lanca after gaining access to a supply of chloroform or ether, which are compounds more widely available in medical school instructional laboratories and some university chemistry labs, as compared to more tightly controlled chemistry labs at secondary school levels. That is, in contrast to relatively open access to other inhalants such as glue or nail polish, lanca historically has had a more restricted supply and distribution chain, leading backward to the university-level laboratory students who often supplied the compound for parties with friends (Mesquita et al., 1998).

With social diffusion models in mind, and in light of the social and epidemiological features of lanca use, supply, and distribution, we anticipated that lanca use would show pronounced clustering within relatively privileged environments of the urban private school classroom, that is, with occurrence of newly incident lanca use being dependent upon the social rank variations within classrooms, and with evidence of within-classroom clustering of lanca use as estimated using an alternating logistic regressions (ALR) approach. When ALR estimates fail to disclose tangible levels of clusters of drug use within classrooms, the null evidence makes it more difficult to argue for person-to-person social diffusion of drug use within these groups (Bobashev and Anthony, 2000; Delva et al., 2000; Petronis and Anthony, 2000).

In addition to our expectation of within-classroom clusters of newly incident lanca use, we posited a direct social rank gradient based on an historically general over-representation of lanca use among the well-to-do in Brazil, even within the privileged classrooms of private school, where there is residual heterogeneity in social rank levels, as shown in the empirically derived distributions of the present investigation. In order to study this aspect of social rank gradients in lanca epidemiology, we turned to the conditional form of logistic regression (CLR), which holds constant all socially shared characteristics of school and classroom environment, via matching, even when these characteristics have not been measured explicitly, in order to focus estimation on individual-level characteristics such as person's social rank.

This study is focused on hypotheses about newly incident drug use; we advance no hypotheses about persistence of use, nor drug use disorders. Nonetheless, for completeness, we have studied two forms of lanca involvement: (a) newly incident lanca use within the two years prior to survey as a manifestation of its incidence and (b) recently active use of lanca in the month prior to survey as a manifestation of its prevalence. In relation to recently active or 'prevalent' use of lanca, the influence of social rank might be expressed on either duration (persistence) of use once it starts, or on incidence rates, or both [given that odds of lanca use in a given month will vary as a function of duration (persistence) of use as well as new onsets]. By studying onsets of lanca use within two years prior to survey, we sought to study the most newly incident lanca users; those starting to use lanca in the past month or year were too scarce when onsets were limited in this fashion. As such, the study sample of newly incident lanca users specified in relation to two years prior to survey provides some degree of control over the issue of persistence in that many users try a drug once and then do not persist, as described recently in relation to tobacco smoking by Barondess et al. (2010).

In summary, this investigation originated as an effort to test hypotheses about whether the diffusion of lanca within higher social status students might yield within-classroom clustering and a direct association between social rank and occurrence of lanca use within the social context of private school life in Brazil's mega-city Sao Paulo, where almost all of the students are from the middle-higher social ranks. The investigation has developed into a more comprehensive research project on the clustering and occurrence of lanca use within the private school classroom, as one example of a micro-social environment or ecological niche with many socially shared facets. Other drugs are considered solely for comparative purposes in relation to the social rank hypotheses, and with some degree of expectation that direct social rank relationships might be found for some drugs in this context (e.g., lanca), but not for alcohol, tobacco, or ubiquitous inhalants such as glue or nail polish. As we shall see, the epidemiological evidence of this study speaks clearly to questions about whether lanca use clusters within private school classrooms and whether there is a direct social rank gradient in that specific context; it leaves uncertainty with respect to some of the aspects of the underlying mechanisms or processes that might give rise to the clustering or to social rank relationships. The study evidence is bounded by experiences of private school students, and inferences should not be extended to other populations. We draw the reader's attention to the fact that more than 80% of students in Sao Paulo (and in Brazil) attend public schools.

## 2. Materials and methods

### 2.1. Study design and sample selection

In this study, the research design is that of a cross sectional survey of school-attending youths in São Paulo, Brazil, with classroom survey data collected in 2008 from a sample of the city's 823 private schools. The study's target population was designed as a representative sample of 8th to 12th grade students in these private schools, with two step probability selection such that schools were sampled in relation to strata (e.g., number of classrooms), and then classrooms were sampled; all students in sampled classrooms were asked to participate. For this study of SES it was necessary to exclude the 14% of student-participants who had missing or invalid responses to the SES assessment described below, yielding an analysis sample of 4476 students.

As in the United States Monitoring the Future (US, MTF) surveys of school-attending youths, a replacement approach has been used when there is non-participation at the school level. Here, 37

of the originally sampled schools consented; three were replaced. (For comparison, the MTF report indicates that in some years only 50–55% of the sampled schools consent to participate in these US surveys; Johnston et al., 2009).

The protocol was reviewed and approved by the UNIFESP Research Ethics Committee (Protocol #0930/07). There were provisions for participants to participate anonymously, to decline to participate, and to leave questions unanswered.

## 2.2. Assessment plan

Anonymous standardized self-reported questionnaire data were gathered by a trained team of assessors (graduate students) who worked in each classroom, collectively, with no teacher present. The assessors explained study objectives and distributed questionnaires, with closed form questions adapted from standardized World Health Organization items (Smart et al., 1980).

## 2.3. Key response variables

The key response variables in this study index use of lanca, inhalants (other than lanca), tobacco, alcohol, and internationally regulated drugs (IRD), such as cocaine and cannabis, with discrimination of newly incident users and recently active users. Newly incident users were identified by taking differences between questionnaire-elicited age at first drug use and the age on the survey date, with a requirement that this difference should be equal to 0 or 1, as described in previous research articles (O'Brien and Anthony, 2009; Stone et al., 2007). Recently active drug users had used in the month prior to assessment.

## 2.4. Covariates under study

The social rank measure used in this research is known as the ABEP index, developed by the Associação Brasileira de Empresas de Pesquisa (ABEP, 2008) and used in many types of economic, social, and health studies in Brazil. We considered but then rejected the idea of a model re-specification with additional individual-level covariates such as the student's academic performance, because in the cross-sectional context these characteristics might be a consequence of drug use rather than a determinant of drug use, or they might not qualify as truly 'independent' variables by virtue of shared common causes in this context. In contrast, the ABEP social rank measure is constructed so that it almost certainly does not depend upon the student's drug experiences. Rather, the ABEP index has more to do with the characteristics of the student's family of origin, the parents, possession of various types of household goods (e.g., television sets), and number of housekeepers, largely uninfluenced by student behaviors such as drug use, as explained below.

Standard ABEP values range from A1 (the top rank) to E. In this study sample, due to the privileged nature of private secondary schools in Brazil, only 5% of the students were found to be in the lower social ranks with ABEP values of C or D or E. Accordingly, the study analyses considered five ordered ABEP SES categories: A1, A2, B1, B2, versus C/D/E combined. Mean family income (MFI) at the E-level of the ABEP index is very low (below a 'living wage' level considered acceptable for families in the US), whereas a D-level family enjoys an MFI value roughly 1.5 times the E-level MFI. The C-level MFI is roughly 2–3 times the E-level value. Relative to the E-level MFI, the corresponding ratios for the higher levels are as follows: A1: MFI 27 times greater than E-level MFI; A2, 17 times; B1: 9 times; B2: 5 times.

The guiding conceptual model was one in which the SES-lanca association in specific and the SES-drug association in general might be direct, as a manifestation of the types of processes

described in this paper's introduction, with the exceptions as noted (alcohol, tobacco, and inhalants other than lanca). Nonetheless, due to the possibility of imbalance across the drug-SES subgroups, the regression models include terms for age and sex as well. As noted above, for this research on SES, it was necessary to exclude students with missing or invalid SES data. Otherwise, with respect to key variables under study, there was a modest degree of missing and/or invalid data, with generally 0.5–2% missing. For example, 0.5% of the students had missing or invalid data on lifetime history of drinking alcohol, whereas 2% of the students had missing or invalid data on age and sex.

## 2.5. Analysis approach

In standard "explore, analyze, explore" cycles, the first exploratory steps involved descriptive cross tabulations. Initial analyze/estimation steps involved fitting alternating logistic regression models with covariates to estimate PWOR for within-classroom clustering of drug outcomes, followed by ALR for both classrooms and schools. Thereafter, we estimated hypothesized ABEP-drug associations using conditional logistic regressions (CLR) for within-classroom matched data. Post-estimation exploratory steps included checks on regression model assumptions.

SAS PROC GENMOD (V9) yields ALR models with PWOR parameters to address survey design effects (Bobashev and Anthony, 2000). Stata (V11) yields CLR models, with svyset for complex sample design variance and 95% confidence interval (CI) estimation.

## 3. Results

Table 1 describes the study sample for drugs and covariates under study in terms of unweighted counts, weighted and unweighted proportions, and 95% CI. To illustrate, among 4476 private school students, 464 youths were at ABEP top rank (A1); corresponding numbers for lower ranks were 1492, 1439, 833, and 248, respectively.

With and without covariate terms for age, sex, and SES, lanca use showed moderate within-classroom clustering. To illustrate, PWOR estimates for clustering of newly incident lanca use and of recently active lanca use were 2.1 (95% CI = 1.3, 3.3;  $p = 0.002$ ) 1.9 (95% CI = 1.1, 3.3;  $p = 0.02$ ), respectively, data not shown in a table). The three-level ALR (students within classrooms within schools) disclosed no residual school-level clustering of lanca use, once this classroom-level clustering was taken into account ( $p > 0.05$ ; data not shown in a table).

ALR and CLR models confirmed hypotheses about SES and newly incident lanca use, with and without age and sex terms. To illustrate, for youths in the lower ABEP ranks (C/D/E), the odds of recent onset of lanca use was an estimated one-fifth of the odds observed for youths in the topmost ABEP rank (A1) – i.e. OR = 0.2, irrespective of covariate adjustment (Table 2,  $p = 0.02$ ; Table 3,  $p = 0.03$ ). Tables 2 and 3 also show that the OR point estimates followed a direct gradient across the A2, B1, and B2 subgroups. As reported in Tables 4 and 5, the lanca OR estimates for recently active (i.e., prevalent) use can be seen to be not appreciably different from corresponding estimates for newly incident lanca use. The A1 versus C/D/E contrasts are direct, and follow a general direct gradient from top SES across lower ABEP values.

Nonetheless, as shown in Tables 2 and 3, the direct social rank association with newly incident drug use also was observed for inhalants other than lanca, for tobacco smoking, and for internationally regulated drugs, without covariate adjustments (Table 2) and with covariate adjustment for age and sex (Table 3). For alcoholic beverages, the odds of newly incident drinking was no

**Table 1**Description of the study sample in terms of unweighted data, weighted prevalence proportions, and 95% CI. Data from Sao Paulo City private school survey, Brazil, 2008 ( $n = 4476$ ).

	N	%		95% CI	
		Unweighted	Weighted	Min	Max
<b>SES</b>					
A1 (highest rank)	464	10	11	7	16
A2	1492	33	34	30	39
B1	1439	32	32	28	35
B2	833	19	18	15	23
C/D/E	248	6	5	4	7
<b>Sex</b>					
Male	2135	48	50	47	52
Female	2269	52	50	47	52
<b>Grade</b>					
8th	1065	24	23	18	28
9th	1014	23	21	18	26
10th	829	19	20	16	25
11th	865	19	19	15	23
12th	703	15	17	13	21
<b>Age group</b>					
12 thru 14	1943	44	41	34	51
15 thru 17	2331	53	55	46	65
18 and up	128	3	4	2	5
<b>Newly incident use of</b>					
Lanca	Yes	45	1	1	2
	No	4431	99	99	99
Inhalant	Yes	245	6	6	8
	No	3864	94	94	95
Alcohol	Yes	888	51	52	55
	No	863	49	48	52
Tobacco	Yes	421	11	11	13
	No	3363	89	89	91
IRD	Yes	80	2	2	2
	No	3909	98	98	99
<b>Recently active use of</b>					
Lanca	Yes	94	2	2	3
	No	4370	98	98	99
Inhalant	Yes	62	2	2	3
	No	4304	98	98	99
Alcohol	Yes	1803	40	40	45
	No	2659	60	60	64
Tobacco	Yes	466	10	11	13
	No	4002	90	89	91
IRD	Yes	332	7	7	9
	No	4144	93	93	94

SES: social rank according to ABEP classification.

**Table 2**Unadjusted odds ratios estimated from conditional logistic regression for SES in relation to newly incident drug use, with classroom-level matching. Data from Sao Paulo City private school survey, Brazil, 2008 ( $n = 4476$ ).

Newly Incident	( $n^b$ )	Pr	SES $n^a$	A1 464	A2 1492	B1 1439	B2 833	CDE 248
Use of lanca	94	11.7%	OR 95% CI $p$	ref	0.8 0.4, 1.7 0.60	0.5 0.2, 1.1 0.10	0.4 0.2, 0.9 0.04	0.2 0.1, 0.8 0.02
Use of inhalant drugs other than lanca	62	14.5%	OR 95% CI $p$	ref	0.7 0.4, 1.1 0.100	0.6 0.3, 0.9 0.020	0.5 0.3, 0.9 0.010	0.3 0.1, 0.7 0.005
Drinking of alcoholic beverages	1083	14.1%	OR 95% CI $p$	ref	0.6 0.4, 0.9 0.010	0.5 0.3, 0.7 0.001	0.6 0.3, 0.9 0.010	0.7 0.4, 1.3 0.400
Smoking of tobacco	466	16.1%	OR 95% CI $p$	ref	0.6 0.4, 0.8 0.002	0.6 0.4, 0.8 0.004	0.4 0.3, 0.7 <0.001	0.4 0.2, 0.8 0.008
Use of internationally regulated drugs IRD	332	19.9%	OR 95% CI $p$	ref	0.4 0.2, 0.9 0.020	0.3 0.1, 0.7 0.005	0.3 0.1, 0.8 0.010	No newly incident users

SES: social rank according to ABEP classification;  $n^a$ : unweighted number of youths at each family SES rank; OR: odds ratio estimate from conditional form of logistic regression, no other covariates in the model, where 'ref' indicates that the highest social rank served as the reference category for estimation of the odds ratios; CI: confidence interval;  $p$ :  $p$ -value under the null hypothesis of no association between SES and drug use occurrence as studied here;  $n^b$ : unweighted number of drug-using youths in the highest SES rank (A1); Pr: estimated prevalence of recently active use of each drug listed in the highest SES (A1) rank.

**Table 3**  
Covariate-adjusted odds ratios estimated from conditional logistic regression for SES in relation to newly incident drug use, with classroom-level matching and covariate adjustment for sex and age. Data from Sao Paulo City private school survey, Brazil, 2008 ( $n = 4476$ ).

Newly Incident	SES	A1	A2	B1	B2	CDE
Use of lanca	OR	ref	0.9	0.6	0.4	0.2
	95% CI		0.4, 1.9	0.2, 1.3	0.2, 1.1	0.1, 0.8
	<i>p</i>		0.70	0.20	0.10	0.03
Use of inhalant drugs other than lanca	OR	ref	0.7	0.6	0.5	0.3
	95% CI		0.4, 1.1	0.3, 0.9	0.3, 0.9	0.1, 0.7
	<i>p</i>		0.100	0.020	0.020	0.003
Drinking of alcoholic beverages	OR	ref	0.6	0.5	0.6	0.7
	95% CI		0.4, 0.9	0.3, 0.8	0.3, 0.9	0.4, 1.4
	<i>p</i>		0.020	0.002	0.020	0.400
Smoking of tobacco	OR	ref	0.6	0.6	0.5	0.4
	95% CI		0.4, 0.8	0.4, 0.8	0.3, 0.7	0.2, 0.8
	<i>p</i>		0.003	0.004	0.001	0.004
Use of internationally regulated drugs IRD	OR	ref	0.5	0.3	0.4	No newly incident users
	95% CI		0.2, 0.9	0.1, 0.7	0.2, 0.9	
	<i>p</i>		0.040	0.008	0.030	

SES: social rank according to ABEP classification; OR: odds ratio estimate from conditional form of logistic regression, with age and sex as covariates in the model, where 'ref' indicates that the highest social rank served as the reference category for estimation of the odds ratios; CI: confidence interval; *p*: *p*-value under the null hypothesis of no association between SES and drug use occurrence as studied here.

**Table 4**  
Unadjusted odds ratios estimated from conditional logistic regression for SES in relation to recently active (past month) drug use, with classroom-level matching. Data from private school survey, Sao Paulo, Brazil, 2008.

Recently active	SES	A1	A2	B1	B2	CDE
Use of lanca	OR	ref	0.8	0.5	0.4	0.2
	95% CI		0.4, 1.7	0.2, 1.1	0.2, 0.9	0.1, 0.8
	<i>p</i>		0.50	0.09	0.04	0.02
Use of inhalant drugs other than lanca	OR	ref	0.9	1.2	0.9	1.1
	95% CI		0.4, 2.0	0.5, 3.1	0.3, 2.7	0.2, 4.6
	<i>p</i>		0.7	0.6	0.9	0.9
Drinking of alcoholic beverages	OR	ref	0.8	0.6	0.5	0.5
	95% CI		0.6, 0.9	0.4, 0.7	0.4, 0.7	0.4, 0.8
	<i>p</i>		0.020	<0.001	<0.001	0.001
Smoking of tobacco	OR	ref	0.6	0.5	0.3	0.4
	95% CI		0.4, 0.8	0.3, 0.7	0.2, 0.5	0.2, 0.8
	<i>p</i>		0.003	<0.001	<0.001	0.004
Use of internationally regulated drugs IRD	OR	ref	0.6	0.4	0.4	0.3
	95% CI		0.4, 0.9	0.2, 0.5	0.3, 0.7	0.1, 0.5
	<i>p</i>		0.010	<0.001	<0.001	<0.001

SES: social rank according to ABEP classification; OR: odds ratio estimate from conditional form of logistic regression, no other covariates in the model, where 'ref' indicates that the highest social rank served as the reference category for estimation of the odds ratios; CI: confidence interval; *p*: *p*-value under the null hypothesis of no association between SES and drug use occurrence as studied here.

**Table 5**  
Covariate-adjusted odds ratios estimated from conditional logistic regression for SES in relation to recently active (past month) drug use, with classroom-level matching. Data from private school survey, Sao Paulo, Brazil, 2008.

Recently active	SES	A1	A2	B1	B2	CDE
Use of lanca	OR	ref	0.9	0.6	0.4	0.2
	95% CI		0.4, 1.8	0.3, 1.3	0.2, 1.1	0.1, 0.8
	<i>p</i>		0.60	0.10	0.07	0.03
Use of inhalant drugs other than lanca	OR	ref	0.9	1.2	1.0	1.3
	95% CI		0.4, 2.0	0.5, 3.0	0.3, 3.0	0.3, 5.7
	<i>p</i>		0.7	0.6	0.9	0.7
Drinking of alcoholic beverages	OR	ref	0.8	0.6	0.5	0.5
	95% CI		0.6, 1.01	0.4, 0.8	0.4, 0.7	0.4, 0.8
	<i>p</i>		0.060	<0.001	<0.001	<0.001
Smoking of tobacco	OR	ref	0.6	0.5	0.3	0.4
	95% CI		0.5, 0.9	0.3, 0.7	0.2, 0.5	0.2, 0.7
	<i>p</i>		0.006	<0.001	<0.001	0.002
Use of internationally regulated drugs IRD	OR	ref	0.7	0.4	0.4	0.3
	95% CI		0.5, 0.9	0.3, 0.6	0.3, 0.7	0.1, 0.5
	<i>p</i>		0.030	<0.001	0.001	<0.001

SES: social rank according to ABEP classification; OR: odds ratio estimate from conditional form of logistic regression, with age and sex as covariates in the model, where 'ref' indicates that the highest social rank served as the reference category for estimation of the odds ratios; CI: confidence interval; *p*: *p*-value under the null hypothesis of no association between SES and drug use occurrence as studied here.



different for the lowest social rank youths as compared to the highest social rank youths in their matched classrooms (Tables 2 and 3).

Tables 4 and 5 provide a similar pattern of findings for recently active use of these drug compounds, with the complexity that the observed prevalent user odds ratios do not clarify whether the associations under study have to do with social rank and becoming a drug user versus social rank versus social rank and persisting in drug use, given that prevalence of drug use varies as a function of both the incidence of becoming a user, as well as the duration of use once it has started. Nonetheless, these estimates are presented for readers not accustomed to the distinction between incidence and prevalence, and who might not appreciate that prevalence relationships fail to clarify whether the processes under study are dynamic in relation to their influence on (or association with) becoming a drug user versus whether the processes under study are static in relation to their influence on (or association with) duration of drug use once it starts.

## 4. Discussion

### 4.1. Recap of main findings

With respect to the lanca use phenomenon in this urban context of Brazil, three substantive findings emerge from this work. First, as hypothesized, via ALR modeling, we have discovered within-classroom clusters of lanca use, consistent with the original concept of lanca as a drug passed from peer to peer within social groups. Second, via CLR modeling, we have discovered evidence that lanca involvement may depend upon social rank, such that lower social rank students within privileged private schools of Brazil are less likely to become newly incident users of lanca and are less likely to have used lanca recently. Third, the observed direct association linking social rank to lanca involvement is not likely to be due to background confounding by age, sex, or socially shared within-classroom characteristics such as drug prevention program variables, local attitudes, or cultural norms of intolerance for drug use. There also was a social rank gradient for the use of inhalants other than lanca and for tobacco smoking, as well as a social rank gradient for cannabis and other IRD, but not for drinking alcohol. Here, we must offer a reminder about this study's boundaries of inference. The lower SES students who attend private schools in Sao Paulo cannot be regarded as a random sample of all lower SES youths in the city. It follows that the boundaries of inference must be set in relation to school context and what we have called the 'ecological niche' of the private school environment.

### 4.2. Research issues

As discussed by Petronis and Anthony (2003) and more recently by Karriker-Jaffe (2011), just as correlation does not imply causation, the clustering of drug use within a geographical area or within a classroom does not imply hand to hand sharing of drugs or a social diffusion or 'contagion' process. When there is geographical concentration of drug using behavior, one potential explanation is a 'birds of a feather flock together' process, as discussed in this study's introduction. This particular process would not seem to operate when classroom clustering of drug use is observed, except when students self-select their classrooms, which was not the case in this study. However, schools are known to 'track' students, making classrooms more homogeneous with respect to observed characteristics such as student achievement test scores or past violations of school rules (e.g., with respect to disruptive behavior). We do not believe that this type of school-driven tracking process has produced the observed within-classroom clusters of drug use in this study, but we do not have firm evidence against this possibility.

For this reason, this study's clustering estimates represent a modest step forward in our understanding of the epidemiology of lanca and other drug use. Future research can attempt to clarify the degree to which the clustering is due to social diffusion or peer-to-peer drug sharing processes, versus alternative processes such as school-driven tracking in classroom assignments.

In new and more probing research, a mixed methods approach combining quantitative survey analysis with qualitative interviewing and social network analysis may help clarify the dynamic processes that produce lanca clustering and the observed social rank gradient (Tashakkori and Teddlie, 2010). Nevertheless, the clustering evidence coupled with the evidence of a direct SES-lanca association lend some support to our hypothesis that lanca use follows a social rank gradient perhaps due to selective sharing of lanca within the higher social rank peer groups.

Ethnographers have investigated how drug using contexts are associated with drug preferences and practices of drug use. Zinberg (1984) in a study among heroin users pointed to the importance of what he called "set" (the social group and its norms and values) and "setting" (the social contexts of use), which jointly can determine an individual's drug use practices, in addition to drug effects per se. Fletcher et al. (2009) note that drug use may enhance peer group affiliation processes by helping new members express a characteristic that is valued within the social group. Bishop et al. (2005) join Burke (2004) in focusing attention on processes of identity formation during social interactions with classmates.

This study's evidence on the general direct social rank gradient for all drugs (other than alcohol) brings to mind another process that might be described as a form of the 'healthy student' effect, somewhat analogous to a 'healthy worker' effect in occupational epidemiology (Shah, 2009). Namely, when studying the health of employed workers versus the unemployed, the workers often have better health status (i.e., more healthy than their unemployed peers in the home neighborhood environment). By analogy, one might think that a lower social rank student who had to work hard to be admitted to a private school in Brazil would also have health advantages as compared to lower social rank students not admitted to private schools and also as compared to higher social rank students whose admission to private school accompanied other privileges of higher social rank of the family of origin, with less demand for exceptionally adaptation at the level of the individual's prior academic performance and behavior. In this study, we cannot make a comparison of lower social rank students in private versus non-private schools, but we can draw the contrast of higher versus lower social rank students within the private school environment. If there is a pronounced 'healthy student' effect in the lower social rank students in private school as compared to the higher social rank students in the same private school, then it might be manifest in a general pattern of direct association linking social rank levels with occurrence of any and all of the drug compounds under study, i.e., no specificity of this direct association with lanca only.

It is also important to note that many North American and European studies find higher prevalence or occurrence of drug use among lower SES adolescents, which has prompted some investigators to advance a social deprivation hypothesis (Daniel et al., 2009; Fothergill and Ensminger, 2006; Helasoja et al., 2007). Goodman and Huang (2002) offer a provocative hypothesis that an SES gradient in health is well established, with higher SES linked to better health. To the extent that use of lanca and other drugs is a manifestation of unhealthy adolescent behavior, the evidence from Brazil's private schools seems to contradict this hypothesis: higher SES youths tend to be overrepresented among Brazilian adolescent drug users, in this investigation and in prior studies (Carlini et al., 2011; De Souza et al., 2005; Galduroz and Caetano, 2004; Pratta and dos Santos, 2007; Soldera et al., 2004). Nonetheless, we acknowledge that the majority of the published Brazilian studies have

been carried out using epidemiological samples of public school students, without coverage of private schools. In future research on lanca, we hope to combine coverage of private and public schools in the same epidemiological field survey operation in Brazil.

#### 4.3. Limitations

Despite the important results found, a few limitations should be mentioned. Some degree of non-participation and data missingness excluded some students from the analysis. However the levels of participation were larger than those obtained in comparable US surveys (Johnston et al., 2009). Additionally, assessment of drug involvement by self-report questionnaires is standard practice globally, but alternatives such as toxicological assays are not available for lanca use. Hence, there may be some degree of misclassification, and perhaps lower social rank students were less likely to disclose drug using behaviors generally, with the exception of alcohol involvement. The anonymous nature of the survey and the absence of the teacher from the classroom should have helped to promote response validity.

The number of low social rank students relative to high social rank students constrained our ability to conduct detailed analyses for comparisons among the extreme SES positions (A and E). Larger sample sizes on the scale of a national survey may help us in future research on this topic.

Notwithstanding limitations such as these, there is reason to reflect upon the implications of this research. If successful, the project may provide some degree of guidance for future theory and field studies on the topic of social status and diffusion of drug-taking behavior in society.

We also would like to note that this study was designed as an effort to understand prior findings on the epidemiology of lanca use in surveys of medical and other university students, almost all of whom attended private schools. Therefore, we took a step back into the ecological niche of the private schools represented in our sample, and did not extend the range of schools to encompass public school students, where a greater proportion of low SES students can be found. The resulting discoveries are pertinent and valid for the ecological niche of the private school environment, and we must appreciate that the lower SES students in this particular ecological niche are not by any means a random sample of all lower SES students in Brazil. By extending this line of research to study SES and drug use in all public and private schools, a null relationship or the expected inverse SES relationship may be found. This future discovery will not mean that the current study evidence is invalid or biased. Rather, such a finding may well remind us of the importance of the ecological niche or school context when we seek to understand epidemiological patterns of youthful drug use.

#### 4.4. Conclusions

In summary, we set out to discover whether there would be classroom level clustering of lanca use among private school students of the Sao Paulo Mega-City in Brazil, and whether the occurrence of lanca use might follow a social rank gradient among private school students in Brazil, with an expectation that newly incident lanca would vary by social rank. The resulting evidence on SES-lanca in specific and SES-drugs in general can be used to promote several lines of more probing research on these associations and the underlying processes such as social sharing of drugs within peer groups and social networks, as well as phenomena such as a possible “healthy student” effect as might account for the observed direct SES association in the context of private schools in Brazil. Given this study’s focused hypotheses on newly incident drug use, one direction for future research might involve new hypotheses about persistence of use or drug use disorders, how

they might cluster within classrooms and schools, and whether they show different relationships with social rank.

#### Role of funding source

Funding for this study was provided by FAPESP (Fundação de Amparo à Pesquisa do Estado de Sao Paulo) #07/50007-0 and #08/54737-6 and AFIP (Associação Fundo de Incentivo a Pesquisa). FAPESP and AFIP had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication.

#### Contributors

Sanchez: statistical analysis, discussion and drafting of the manuscript.

Noto: survey concept, design and supervision

Anthony: analysis conceptualization, data interpretation, discussion and drafting of the manuscript.

All authors contributed to and have approved the final manuscript.

#### Conflict of interest

All the authors declare that they have no conflicts of interest.

#### Acknowledgements

The authors acknowledge John Troost for his help with SAS management. Also we thank FAPESP that funded a post doctoral research internship at the Michigan State University for the first author supervised by the last author.

#### Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.drugalcdep.2012.12.001>.

#### References

- ABEP, 2008. Critério de Classificação Econômica Brasil [Internet]. Associação Brasileira de Empresas de Pesquisa. Available from: [www.abep.org/codigosguias/Criterio Brasil 2008.pdf](http://www.abep.org/codigosguias/Criterio%20Brasil%202008.pdf)
- Balster, R.L., 1997. College on problems of drug dependence presidential address 1996: inhalant abuse, a forgotten drug abuse problem. *NIDA Res. Monogr.* 174, 3–8.
- Balster, R.L., Cruz, S.L., Howard, M.O., Dell, C.A., Cottler, L.B., 2009. Classification of abused inhalants. *Addiction* 104, 878–882.
- Barondess, D.A., Meyer, E.M., Boinapally, P.M., Fairman, B., Anthony, J.C., 2010. Epidemiological evidence on count processes in the formation of tobacco dependence. *Nicotine Tob. Res.* 12, 734–741.
- Bishop, D.I., Weisgram, E.S., Holleque, K.M., Lund, K.E., Wheeler-Anderson, J.R., 2005. Identity development and alcohol consumption: current and retrospective self-reports by college students. *J. Adolesc.* 28, 523–533.
- Bobashev, G.V., Anthony, J.C., 2000. Use of alternating logistic regression in studies of drug-use clustering. *Subst. Use Misuse* 35, 1051–1073.
- Burke, P., 2004. Identities and social structure: the 2003 Cooley-Mead Award address. *Soc. Psychol. Q.* 67, 5–15.
- Carlini, E.A., Noto, A.R., Sanchez, Z.M., 2011. VI Levantamento Nacional sobre o Consumo de Drogas Psicotrópicas entre Estudantes do Ensino Fundamental e Médio das Redes Pública e Privada de Ensino nas 27 Capitais Brasileiras (6th National School Survey about Psychotropic Drugs Among Middle and High School Students in Private and Public Schools at the 27 Brazilian State Capitals). Artprinter, São Paulo.
- Carlini-Cotrim, B., Carlini, E.A., 1988. The use of solvents and other drugs among children and adolescents from a low socioeconomic background: a study in Sao Paulo, Brazil. *Int. J. Addict.* 23, 1145–1156.
- Carvalho, K.A., Sant’Anna, M.J., Coates, V., Omar, H.A., 2008. Medical students: abuse of psychoactive substances and sexuality aspects. *Int. J. Adolesc. Med. Health* 20, 321–328.
- Daniel, J.Z., Hickman, M., Macleod, J., Wiles, N., Lingford-Hughes, A., Farrell, M., Araya, R., Skapinakis, P., Haynes, J., Lewis, G., 2009. Is socioeconomic status in early life

- associated with drug use? A systematic review of the evidence. *Drug Alcohol Rev.* 28, 142–153.
- De Souza, D.P., Areco, K.N., da Silveira Filho, D.X., 2005. Alcohol and alcoholism among Brazilian adolescent public-school students. *Rev. Saude Publica* 39, 585–592.
- Delva, J., Bobashev, G., Gonzalez, G., Cedeno, M., Anthony, J.C., 2000. Clusters of drug involvement in Panama: results from Panama's 1996 National Youth Survey. *Drug Alcohol Depend.* 60, 251–257.
- Duarte, P., Stempliuk, V., Barroso, L.P., 2011. Relatório brasileiro sobre drogas (Brazilian Report on Drugs). SENAD (Secretaria Nacional de Políticas Sobre Drogas), Brasília.
- Fletcher, A., Bonell, C., Sorhaindo, A., Rhodes, T., 2009. Cannabis use and 'safe' identities in an inner-city school risk environment. *Int. J. Drug Policy* 20, 244–250.
- Fothergill, K.E., Ensminger, M.E., 2006. Childhood and adolescent antecedents of drug and alcohol problems: a longitudinal study. *Drug Alcohol Depend.* 82, 61–76.
- Galduroz, J., Caetano, R., 2004. Epidemiology of alcohol use in Brazil. *Rev. Bras. Psiquiatr.* 26 (Suppl.1), S3–S6.
- Galduroz, J., Noto, A., Fonseca, A., Carlini, E., 2005. V Levantamento Nacional sobre o Consumo de Drogas Psicotrópicas entre Estudantes do Ensino Fundamental e Médio da Rede Pública de Ensino nas 27 Capitais Brasileiras. Centro Brasileiro de Informações sobre Drogas Psicotrópicas – Departamento de Psicobiologia da Universidade Federal de São Paulo.
- Goodman, E., Huang, B., 2002. Socioeconomic status, depressive symptoms, and adolescent substance use. *Arch. Pediatr. Adolesc. Med.* 156, 448–453.
- Helasoja, V., Lahelma, E., Prattala, R., Petkeviciene, J., Pudule, I., Tekkel, M., 2007. The sociodemographic patterning of drinking and binge drinking in Estonia, Latvia, Lithuania and Finland, 1994–2002. *BMC Public Health* 7, 241.
- Johnston, L.D., O'Malley, P.M., Bachman, J.G., Schulenberg, J.E., 2009. Monitoring the Future National Survey Results on Drug Use, 1975–2008. Volume I: Secondary School Students. National Institute on Drug Abuse, Bethesda, MD.
- Karriker-Jaffe, K.J., 2011. Areas of disadvantage: a systematic review of effects of area-level socioeconomic status on substance use outcomes. *Drug Alcohol Rev.* 30, 84–95.
- Mesquita, A.M., de Andrade, A.G., Anthony, J.C., 1998. Use of the inhalant lanca by Brazilian medical students. *Subst. Use Misuse* 33, 1667–1680.
- Miech, R., Chilcoat, H., 2007. The formation of a socioeconomic disparity: a case study of cocaine and marijuana use in the 1990s. *Am. J. Prev. Med.* 32, S171–S176.
- O'Brien, M.S., Anthony, J.C., 2009. Extra-medical stimulant dependence among recent initiates. *Drug Alcohol Depend.* 104, 147–155.
- Petronis, K.R., Anthony, J.C., 2000. Perceived risk of cocaine use and experience with cocaine: do they cluster within US neighborhoods and cities? *Drug Alcohol Depend.* 57, 183–192.
- Petronis, K.R., Anthony, J.C., 2003. A different kind of contextual effect: geographical clustering of cocaine incidence in the USA. *J. Epidemiol. Community Health* 57, 893–900.
- Pratta, E.M., dos Santos, M.A., 2007. Adolescence and the consumption of psychoactive substances: the impact of the socioeconomic status. *Rev. Lat. Am. Enfermagem* 15, Spec. No, 806–811.
- Shah, D., 2009. Healthy worker effect phenomenon. *Indian J. Occup. Environ. Med.* 13, 77–79.
- Smart, R.G., Hughes, D.P.H., Johnston, L.D., 1980. Methodology for Students Drug-Use Surveys. World Health Organization, Geneva.
- Soldera, M., Dalgalarrodo, P., Correa Filho, H.R., Silva, C.A., 2004. Use of psychotropic drugs among students: prevalence and associated social factors. *Rev. Saude Publica* 38, 277–283.
- Stone, A.L., O'Brien, M.S., De la Torre, A., Anthony, J.C., 2007. Who is becoming hallucinogen dependent soon after hallucinogen use starts? *Drug Alcohol Depend.* 87, 153–163.
- Tashakkori, A., Teddlie, C., 2010. *SAGE Handbook of Mixed Methods in Social and Behavioral Research*. SAGE, Thousand Oaks.
- WorldBank, 2011. *Atlas of Global Development*. HarperCollins Publishers, Washington.
- Zinberg, N.E., 1984. *Drug, Set and Setting: The Basis for Controlled Intoxicant Use*. Yale University Press, New Haven.