The PACARDO research project: youthful drug involvement in Central America and the Dominican Republic

Catherine M. Dormitzer,[1] *Gonzalo B. Gonzalez,*[2] *Marcel Penna,*[3] *Julio Bejarano,*[4] *Patricia Obando,*[5] *Mauricio Sanchez,*[6] *Kenneth Vittetoe,*[7] *Ulises Gutierrez,*[8] *Juan Alfaro,*[9] *Guillermo Meneses,*[10] *Jorge Bolivar Diaz,*[11] *Manuel Herrera,*[12] *Julia Hasbun,*[12] *Anna Chisman,*[13] *Luis Caris,*[14] *Chuan-Yu Chen,*[1] *and James C. Anthony* [1,15]

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ABSTRACT

Objective. *To estimate the occurrence and school-level clustering of drug involvement among school-attending adolescent youths in each of seven countries in Latin America, drawing upon evidence from the PACARDO research project, a multinational collaborative epidemiological research study.*

Methods. *During 1999-2000, anonymous self-administered questionnaires on drug involvement and related behaviors were administered to a cross-sectional, nationally representative sample that included a total of 12 797 students in the following seven countries: Costa Rica (*n = *1 702), the Dominican Republic (*n = *2 023), El Salvador (*n = *1 628), Guatemala (*n = *2 530), Honduras (*n = *1 752), Nicaragua (*n = *1 419), and Panama (*n = *1 743). (The PACARDO name concatenates PA for* Panamá, *CA for* Centroamérica, *and RDO for* República Dominicana*). Estimates for exposure opportunity and actual use of alcohol, tobacco, inhalants, marijuana, cocaine (crack/coca paste), amphetamines and methamphetamines, tranquilizers, ecstasy, and heroin were assessed via responses about questions on age of first chance to try each drug, and first use. Logistic regression models accounting for the complex survey design were used to estimate the associations of interest.*

[1] The Johns Hopkins University, Bloomberg School of Public Health, Department of Mental Health, Baltimore, Maryland, United States of America.
[2] Hospital Regional Nicolás A. Solano, Servicio de Psiquiatría, Cuidad de Panamá, Panamá.
[3] Hospital Santo Tomás, Servicio de Psiquiatría, Cuidad de Panamá, Panamá.
[4] Instituto sobre Alcoholismo y Farmacodependencia, San José, Costa Rica.
[5] Virginia Commonwealth University, Institute for Women's Health and Psychology Department, Richmond, Virginia, United States.
[6] Universidad Nacional Autónoma de Nicaragua, Managua, Nicaragua.
[7] Universidad Nacional Autónoma de Honduras, Facultad de Medicina, Departamento de Psiquiatría, Tegucigalpa, Honduras.
[8] Ministerio de Salud, Hospital Nacional Psiquiátrico, San Salvador, El Salvador.
[9] Escuela Mónica Herrera, Santa Tecla, La Libertad, El Salvador.
[10] Guillermo Meneses is deceased; he was with the Dirección General de Servicios de Salud, Departamento Nacional de Salud Mental, Proyecto de Epidemiología, Cuidad de Guatemala, Guatemala.
[11] Patronato Pro Rehabilitación del Drogadicto, Ciudad de Guatemala, Guatemala.
[12] Consejo Nacional de Drogas, Santo Domingo, República Dominicana.
[13] Organization of American States, Washington, D.C., United States.
[14] Universidad de Chile, Santiago de Chile, Chile.
[15] Michigan State University, College of Human Medicine, Department of Epidemiology, East Lansing, Michigan, United States. Send correspondence to: James C. Anthony, Department of Epidemiology, College of Human Medicine, Michigan State University, B601 West Fee Hall, East Lansing, Michigan 48824, United States; telephone: 517-353-8623 ext100; fax: 517-432-1130; e-mail: janthony@msu.edu

Results. *Cumulative occurrence estimates for alcohol, tobacco, inhalants, marijuana, and illegal drug use for the overall sample were, respectively: 52%, 29%, 5%, 4%, and 5%. In comparison to females, males were more likely to use alcohol, tobacco, inhalants, marijuana, and illegal drugs; the odds ratio estimates were 1.3, 2.1, 1.6, 4.1, and 3.2, respectively. School-level clustering was noted in all countries for alcohol and tobacco use; it was also noted in Costa Rica, El Salvador, Guatemala, and Panama for illegal drug use.*

Conclusions. *This report sheds new light on adolescent drug experiences in Panama, the five Spanish-heritage countries of Central America, and the Dominican Republic, and presents the first estimates of school-level clustering of youthful drug involvement in these seven countries. Placed in relation to school survey findings from North America and Europe, these estimates indicate lower levels of drug involvement in these seven countries of the Americas. For example, in the United States of America 70% of surveyed youths had tried alcohol and 59% had smoked tobacco. By comparison, in these seven countries, only 51% have tried alcohol and only 29% have smoked tobacco. Future research will help to clarify explanations for the observed variations across different countries of the world. In the meantime, strengthening of school-based and other prevention efforts in the seven-country PACARDO area may help these countries slow the spread of youthful drug involvement, reduce school-level clustering, and avoid the periodic epidemics of illegal drug use that have been experienced in North America.*

Key words Adolescent, adolescent behavior, alcohol drinking, smoking, substance-related disorders, Central America, Dominican Republic.

The aim of this paper is to estimate the occurrence and school-level clustering of drug involvement among adolescent youths in each of seven countries of Latin America, drawing upon evidence from the PACARDO research project, a multinational collaborative epidemiological research project. During 1999–2000 the same study protocol was used for sampling and data-gathering in each of the participating countries: five Spanish-heritage countries of Central America (Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua), Panama (which is sometimes classified as being part of Central America), and the Caribbean nation of the Dominican Republic. The PACARDO name concatenates PA for *Panamá*, CA for *Centroamérica*, and RDO for *República Dominicana*.

Background for this report now includes a growing body of research on the epidemiology of adolescent drug involvement in these countries of the Americas, with prior contributions by members of our own research group, and by others. As shown in Table 1, most of the published evidence is from Panama and Costa Rica (1–6). For example, according to the 1996 Panama National Youth Survey over 40% of school-attending adolescents had started to drink alcohol, while a much smaller proportion had used marijuana and inhalant drugs; the use of cocaine (crack/coca paste) and heroin was quite rare (1–6). Summarizing evidence from pilot surveys conducted in anticipation of our PACARDO project, Vittetoe and colleagues (4) found substantial between-country variation in cumulative occurrence of tobacco experience, with estimates of tobacco smoking ranging from 3% of school-attending youths in the Dominican Republic to more than 25% of school-attending youths in El Salvador. However, in this preparatory pilot work, the sampling and data-gathering methods were not held constant across countries, and methodological differences may account for observed variation of the estimates. More recent Global Youth Tobacco Survey data also reflect between-country variability in tobacco smoking experiences within the seven PACARDO countries (7–9).

Beyond useful epidemiological surveillance research of the type just described, there have been a few studies seeking evidence on suspected causal determinants for adolescent drug involvement in the seven PACARDO countries. For example, Vittetoe and colleagues (4) found that in most of those countries a higher level of conduct problems was associated with cumulative occurrence of tobacco use, reflecting what may be a causal relationship. In studies of youths in Costa Rica, Sandi and colleagues (3) found that adolescent drug use co-occurred with family relations problems and delinquency. Delva and colleagues, studying school-attending youths in Panama, found evidence consistent with "social contagion" of drug involvement (2). That is, there was a tangible level of clustering of drug involvement within schools, over and above what might be expected in relation to the composition of the student bodies (e.g., in relation to age and sex). Previously, Delva and colleagues had shown that male students in Panama were more likely to have had opportunities to try drugs as compared to female students, but that females were just as likely as males to initiate drug use once the opportunity arose (1). This finding from Panama is consistent with evidence reported by Van Etten and Anthony, whose epidemiological research was based on national surveys of young people in the United States (10).

TABLE 1. Overview of published studies on the epidemiology of adolescent drug use in Panama, Central America, and the Dominican Republic

Author (years)	Population	Study design	Sample size	Age/school grade	Types of estimates and findings
Witting et al. (1997) (Ref. 5)	Street and market children in Honduras	Convenience sample/UNICEF survey	1 244	10–13 yr	The authors suggest associations linking inhalant use with demographic factors, cultural influences, and structural effects.
Gonzalez et al. (1999) (Ref. 6)	1996 National Youth Survey on Alcohol and Drug Use in Panama	Cross-sectional school survey	6 477	12–18 yr	Estimated prevalence of tobacco, alcohol, marijuana, tranquilizers, inhalants, stimulants, cocaine, crack cocaine, pasta base, hallucinogens, and heroin use in public/private schools, and in urban/rural areas.
Delva et al. (2000) (Ref. 2)	1996 National Youth Survey on Alcohol and Drug Use in Panama	Cross-sectional school survey	6 477	12–18 yr	Estimated prevalence of recently active tobacco, alcohol, and other drug use.
Sandi et al. (2002) (Ref. 3)	A rural area in Costa Rica, 1995	Cross-sectional school survey	304	Grade 7–11	The authors found evidence of school-level clustering of youthful use of tobacco, alcohol, inhalants, and other drugs (marijuana, tranquilizers, stimulants, cocaine-hydrochloride, crack cocaine, pasta base, hallucinogens, and heroin). This clustering was evident even with statistical adjustments for sex, age, type of school, and region within the country.
Vittetoe et al. (2002) (Ref. 4)	1994 convenience sample surveys in Panama, the five Spanish heritage countries of Central America, and the Dominican Republic	Cross-sectional school survey	5 549	12–19 yr	Estimated prevalence of youthful use of tobacco, alcohol, inhalants, benzodiazepines, and illegal drugs (i.e., marijuana, cocaine). Severity indices are reported in relation to history of drug involvement. Drug Use Screening Inventory severity indices for depression, rebelliousness, and isolation are reported in relation to the history of drug involvement. Estimated prevalence of tobacco use in public/private schools, and urban/rural areas. The authors found evidence that conduct and behavioral problems are linked with occurrence of tobacco in the seven countries of the PACARDO project.

In this paper we seek to add to the growing body of empirical work on adolescent drug involvement in the Americas, with a contribution of evidence from a cross-national collaborative project designed with a deliberate intent to foster cross-national comparisons as well as comparisons within each of the seven participating countries. The intent to draw cross-country comparisons accounts for the PACARDO research project's focus on school-attending youths in the middle adolescent years. Elsewhere, we have proposed to survey youths not in school within these countries—for example, with street-intercept sampling of youthful pedestrians in plazas, street markets, and other locations. However, this sampling method necessarily must be crafted to the individual circumstances of each country, and among the PACARDO countries there is considerable variation in such characteristics as total population, the proportion of the population living in urban areas, literacy levels, and income (Table 2). Between-country variation of this type makes cross-country comparison quite difficult unless the research protocol is tightly constrained. As such, in this article, with the goal of cross-country comparison, we retain a focus on school-attending youths who were in middle adolescence during the closing years of the 20th century. While we do not wish to minimize the importance of research on school dropouts and street children, the drug involvement of school-attending youth is of interest for many reasons, including the fact that in the 21st century many of the leaders of these countries will likely come from the youthful population now attending school.

TABLE 2. Core health and socioeconomic data for the seven PACARDO countries, 2000

	Panama	Costa Rica	Nicaragua	Honduras	El Salvador	Guatemala	Dominican Republic
Population (in thousands)	2 899	4 112	5 215	6 656	6 398	11 687	8 624
Proportion urban (%)	56.6	48.1	56.5	53.6	47.0	40.0	65.6
Literacy rate, male (%)	92.6	95.5	64.2	72.5	81.6	76.2	84.0
Literacy rate, female (%)	91.3	95.7	64.4	72.0	76.1	61.1	83.7
Gross national product per capita (US$)	5 450	7 880	2 060	2 270	4 260	3 630	5 210
Income ratio, highest 20% to lowest 20%	25.9	13.0	13.1	17.1	16.6	30.0	13.3
Proportion (%) below international poverty line	. . . [a]	9.6	43.8	40.5	26.0	. . .	. . .

Source: Pan American Health Organization, Regional Core Health Data System.
[a] The ellipsis points (. . .) indicate the information was not available.

MATERIALS AND METHODS

Background, research design, and population under study

Building from pilot studies conducted under the auspices of the Inter-American Drug Abuse Control Commission, the Organization of American States (OAS), and the Pan American Health Organization (PAHO), the PACARDO research group had an experienced principal investigator (PI) and research team in each participating country (Gonzalo B. Gonzalez, Marcel Penna, Julio Bejarano, Mauricio Sanchez, Kenneth Vittetoe, Ulises Gonzalez, Juan Alfaro, Rodolfo Kepfer, Jorge Bolivar Diaz, Manuel Herrera, Julia Hasbun) as well as a PI and research trainees in the United States (James C. Anthony, Catherine Dormitzer, Chuan-Yu Chen) whose work was sponsored by the National Institute on Drug Abuse and the Johns Hopkins University. Technical assistance and other expertise were provided by the OAS (Anna Chisman), PAHO (Enrique Madrigal), and the Universidad de Chile (Luis Caris).

A cross-sectional research design was chosen for the PACARDO project, with the intent to use the cross-sectional study experience to create expertise needed for more complex future investigations with longitudinal and randomized intervention designs. The ministry of education in each country was able to provide a complete list of public and private schools. This list of schools constituted the initial sampling frame from which each country's population of school-attending adolescents was sampled.

Our goal was to have all data gathered in 1999, but due to natural disasters in 1999, data-gathering in El Salvador was postponed until calendar year 2000. A target goal for statistical precision was 1 400 to 1 500 youths in each country's sample, for a total sample size of about 10 150 students. In actuality, a total of 12 797 students participated: Costa Rica (n = 1 702), the Dominican Republic (n = 2 023), El Salvador (n = 1 628), Guatemala (n = 2 530), Honduras (n = 1 752), Nicaragua (n = 1 419), and Panama (n = 1 743).

Sampling, participation, and protection of human subjects

Methods of probability sampling created a nested structure: youths within schools, and schools within departments (or provinces) of each country. From each country's sampling frame (the complete list of public and private schools), 55–75 schools were designated probabilistically, using a balanced stratified sampling approach originally developed by Professor Richard Royall of Johns Hopkins University and described elsewhere (11, 12). In five countries, initially sampled strata were formed in relation to the departments of the country; the sampling of schools ensured appropriate balance in representation of students from departments with small populations as well as students from the capital city and other similarly populous regions. Given its small geographic size and densely congregated population, El Salvador's sample was drawn from every department of the country.

After probability sampling to designate schools, members of the study team rostered classrooms within each designated school, seeking to identify and include all classrooms that included 16-year-old pupils. That is, our intent was to secure a sample with a mean age of roughly 16 years in each country. From this roster, one, two, or three classrooms were randomly selected within each designated school, based on school size. Rather than pull out the 16-year-olds for survey, all youths in the designated classrooms were recruited for assessment during a regular classroom session. The result was an approximate self-weighted sample (11, 12), with a mean age of 16 years and with an age range reflecting the inclusion of younger and older youths within these classrooms. In several countries, especially within smaller schools, 16-year-olds are grouped in classrooms with youths as young as 10 years and as old as young adults, and our sample reflects these educational practices. For this reason, age (in years) is included as a covariate in our analysis plan.

Strong involvement of in-country principal investigators, coupled with support and enthusiasm within the ministries of education and health, resulted in all school directors and principals agreeing to participate in the survey. However, for practical rea-

sons, there were several instances that required designation of comparable replacement schools, mainly due to natural disasters, school destruction, and an occasional mismatch between the central list of schools maintained by the ministry and the actual geographic location of the school. For example, we encountered listed schools that had been relocated due to damage caused by hurricane winds, water, or mud slides. Occasionally, a listed school was found to cater solely to adult learners (i.e., no students age 16 years). When this occurred, a similar school was selected at random from the same department of the country, with selection procedures modeled after those used to select replacement schools for the Monitoring the Future survey of school-attending youths in the United States (13). In actual practice there were replacements of this type in only three countries: El Salvador (four schools), Honduras (three schools), and Nicaragua (three schools). There was 100% participation by the initially designated schools in Costa Rica, the Dominican Republic, Guatemala, and Panama.

In addition to this excellent school-level participation, there was very good participation by students in the classrooms designated for sampling. The PACARDO project's "passive" parental consent process involved contact with parents via a letter from the school director, sent home on the days prior to the assessment session; no parental signature was required. This letter explained the purposes and contents of the survey, and it instructed parents to advise their children to opt out of the survey if they so chose. "Opting out" involved allowing the youth to mark a symbol to designate a missing value for all questions on the survey form. During the assessment session an active assent process was in place; youths could decline to answer any and all questions if they did not wish to participate, even if their parents had consented to allow them to participate. In actual practice, nonparticipation in this form was atypical: only 2 students marked missing value symbols for *all* survey item responses, and 143 students marked missing value symbols for all survey items related to drug exposure opportunities and actual use. Thus, the survey team achieved participation by more than 98% of the designated sample of school-attending youths. In theory, student-level nonparticipation also might have occurred if parents instructed their children to stay home from school on the posted days of assessment. This practice, if it occurred, seems to have been rare. Based on classroom-level data provided by teachers, student absenteeism rates were not unusual on the days of assessment, that is, in a range of 5% to 7% in Costa Rica and Panama, with even lower absenteeism rates in the other countries surveyed.

The overall study protocol was approved by a United States National Institutes of Health initial review group, which reviewed scientific merit and public health significance of the work prior to award of National Institute on Drug Abuse funds, as well as human subjects protections. The protocol was also reviewed and approved by the Institutional Review Board ("Human Ethics" IRB) of the sponsoring university in the United States (Johns Hopkins University), and by independent human subject committees in all seven countries where the school surveys were completed.

Assessment procedures, including a three-part assessment protocol

Each country's leadership team recruited and trained field research staff according to a standardized PACARDO research project protocol, and also dispatched a pair of assessors (a lead assessor and an assistant) to each designated school. The standard multicountry protocol required the assessors to visit the school for an initial assessment session of 60 to 90 minutes within a designated classroom, and then to return for a second session, also of 60 to 90 minutes, that sought to assess the youths from that classroom who had been absent on the first day. On the day of the first visit the assessors met and answered questions posed by the school director or principal, and laid out an assessment schedule, typically with no more than one classroom-based assessment session completed each morning and one completed each afternoon. In some of the larger schools, up to three days of work were required to complete the assessment process.

Within each designated classroom the lead assessor and the assistant followed the PACARDO research project's three-part assessment protocol, which was designed to improve the quality and accuracy of the study evidence. For the first part, the school director brought the assessors to the classroom and introduced them to the teacher and youths seated in the classroom. The school director, teacher, and assistant assessor then left the classroom in charge of the team's lead assessor. While the lead assessor was introducing the survey to the youths, the assistant provided the teacher with instructions about completion of standardized ratings (described below); once the teacher started to make these ratings, the assistant returned to assist the lead assessor in the classroom.

Within the classroom the lead assessor's first tasks were to describe the survey and to work through issues of trust and rapport, prior to distribution of the preprinted questionnaire form. All items on this questionnaire were subjected to a translation-backtranslation-harmonization process that helped promote comprehension of the Spanish-language survey items by the participating youths. The questionnaire was group-paced but self-administered. This first part of the assessment protocol was structured in a manner that actually encouraged the youths to voice concerns about the anonymity and confidentiality of the study data; our idea was that these concerns should be made public and discussed, with resolution in the form of increased trust and rapport. A regime of drug prohibition is in place within each participating country, as it is within the United States, so the accuracy and completeness of the self-report youth survey data depended on the youths

being confident that their answers would be anonymous. In addition, explicit assurance was needed that the survey results on illegal drug activities would be reported in a manner that would thwart repercussions at the individual level and at the school level. At the individual level, an undesirable repercussion could be an arrest for illegal drug use as reported in the survey; at the school level, the police could try to use the survey results to identify schools with high levels of drug use and then send undercover police cadets to those schools in an effort to apprehend drug users, as has been done in the United States. The assessors explained our study procedures for ensuring protection against this type of repercussion, as well as the procedure for marking a missing value symbol (a circled dot) whenever a youth wished to skip any or all survey questions.

The formal survey session started after the assessors worked through these trust and rapport issues. The lead assessor walked through the classroom and distributed a stack of anonymous preprinted questionnaire forms as well as survey pencils. Youths were invited to take any preprinted form in the stack (top, bottom, middle), as an additional safeguard and privacy protection. That is, the youths selected their own forms; they were not preassigned. After distribution of the forms, the lead assessor read out a set of scripted, IRB-approved sentences to formalize the youth assent process. Here again, the lead assessor advised the youths that they had the right to skip any or all survey questions, and that they could mark a missing value symbol whenever they wished to skip a question. As described above, there were youths who declined to participate (i.e., they marked every question with the missing value symbol), and there were youths who declined to answer questions about illegal drug involvement (i.e., they marked the drug use questions with the missing value symbol, but they gave valid responses to the other survey questions.).

The second part of the protocol involved the actual assessment, as structured by 19 zones or modules in the preprinted PACARDO questionnaire. The lead assessor secured the youths' attention and worked through each page of the questionnaire, module by module, reading aloud each question so as to group-pace the process of assessment. As the assessor read each question, the students followed along and marked their own answers. The assistant helped to ensure that privacy was respected and order was maintained, such as by providing quiet answers to idiosyncratic questions from individual students. This approach was designed to overcome interindividual variations in literacy, and it was also intended to reduce what sometimes occurs as "racing" to the end of a self-administered questionnaire and resultant marking errors.

Construct domains covered in the 224-item standardized PACARDO self-report questionnaire are listed in Table 3, along with illustrative items and scales. Initial modules assessed general health constructs and social adaptation, such as are tapped by questions about headaches, positive moods, and getting along with other youths. These first modules help reinforce the idea that our research is focused on youth health and well-being in general, with illegal drug activities being only one area of concentration. The first questions about affiliation with drug-involved peers appear in the 8th module, after 88 questions on other aspects of youth health and well-being. Questions about the youth's own drug involvement begin at PACARDO question 162 in the 15th module, which starts out asking about legal consumption of *chicha* (a widely consumed indigenous alcoholic beverage typically made via fermentation of maize or other local plant material), alcoholic beverages in general, and tobacco. Subsequent modules address illegal drugs (e.g., marijuana, coca paste), prior to a concluding 20-item module modeled after Johanson's Behavioral Repertoire Rating Scale (14).

Unlike prior survey forms used in Latin America, such as the Drug Use Screening Inventory (DUSI), the PACARDO questionnaire's nondrug modules are heterogeneous with respect to item content. Whereas each DUSI module taps just one domain of constructs and all items in the module are about that domain, each PACARDO module contains a mix of topics. For example, items about health are mixed together with items about social adaptation. In addition, the DUSI items are all true/false or yes/no items, with a "yes" response indicating the presence of a problem (e.g., irritable mood). In contrast, PACARDO items were written with a mix of yes/no responses such that "yes" sometimes indicates the presence of a problem (e.g., "Do you feel sad a lot?") and sometimes the absence of a problem (e.g., "During the past six months, have you slept well?"). The PACARDO approach is based on psychometric assessment principles that seek to reduce stereotypical response-marking tendencies and related survey response errors. In contrast, the DUSI approach may yield higher scale-level internal consistency coefficients (e.g., Kuder-Richardson formula 20 for Cronbach's alpha), but the greater internal consistency may be induced by stereotypical response-marking tendencies of the individual student (15, 16).

The third part of the protocol was the closing session, during which the assessors collected the completed questionnaires in a manner that helped promote a sense of confidentiality. Specifically, a large envelope was passed around, and students dropped their completed survey forms into the envelope with no one being able to identify the specific form deposited by an individual student. The assessors sealed and packed away the envelope before engaging in closing exercises that included expressions of gratitude and hope that the youths would agree to participate in future assessments of this type. Youths were allowed to keep the survey pencils as a token of our appreciation for their participation.

While the students were completing the PACARDO questionnaire, the classroom teacher worked on a survey-related task outside the classroom. The survey team had arranged for the teacher to create a list of absentee stu-

TABLE 3. Reliability estimates for construct domains and psychosocial scales administered in the PACARDO study, 1999–2000

Construct name	Estimated reliability KR- 20[a]	No. of items	Sample items in Spanish and English back-translated (True/false response format)
Irritable/crabby	0.72	8	• ¿Te has molestado con facilidad? • Have you easily gotten upset?
Positive mental health	0.71	9	• ¿Durante los últimos 6 meses, ¿has dormido bien? • During the past 6 months, have you slept well?
Mixed distress	0.71	9	• ¿Te has sentido nervioso? • Have you felt nervous (a lot)?
Externalizing behavior	0.84	20	• ¿Durante el último año, has herido o hecho daño a los animales? • During the past year, have you harmed animals?
Family attention	0.70	8	• ¿Usualmente has hablado con tus padres sobre lo que vas a hacer el día siguiente? • Have you usually talked with your parents about your plans for the next day?
Deviant peer affiliation	0.80	8	• ¿Tus amigos han robado o han causado daño a propósito a las cosas de otras personas? • Have your friends stolen things or damaged others' property on purpose?
Poor school adaptation	0.78	20	• ¿Durante los últimos seis meses, tus notas escolares han sido mejores que las de la mayoría de tus compañeros de clase? • During the past 6 months, have your grades been higher than most of your classmates'?
Neighborhood disadvantage	0.73	8	• Hay suficientes lugares seguros para caminar o jugar en mi barrio o vecindario. • There are plenty of safe places to walk or play in my neighborhood.
Peers who use drugs	0.77	6	• Algunos de mis amigos han fumado mariguana. • Some of my friends have smoked marijuana.

[a] Cronbach's alpha reliability estimates derived via Kuder-Richardson formula 20 (KR20).

dents (i.e., students on the classroom roster but who were absent on the date of assessment), and to rate these students as well as a subsample of all other students on the roster. This set of ratings followed a scripted, standardized rating procedure called the Teacher Observation of Classroom Adaptation—Revised (TOCA-R), which the PACARDO project team translated into Spanish, back-translated into English, and harmonized for Spanish language use in this project (17). The teachers also completed a standardized PACARDO rating form on the classroom, school, and school neighborhood environment. This form, called in Spanish the *Medio Ambiente Escolar* (MAMBI), was devised in Spanish for the PACARDO project, and has helped the project team understand the characteristics of the schools, the classrooms within the schools, and the neighborhood surroundings of the school (e.g., residential, industrial, commercial). Results from the TOCA-R and MAMBI will be integrated within future PACARDO project reports.

The process of translation, back-translation, and harmonization of the PACARDO survey questionnaire, TOCA-R, and MAMBI items involved all leaders listed as coauthors of this report and their local area colleagues, as well as pilot testing within these countries. This process helped refine the assessments. For example, in most countries there was a question on well-being: "Ha estado todo bien contigo?" For Costa Rica, however, the following phrasing of the question was deemed more appropriate: "Ha estado todo bien o pura vida con vos?" (Copies of the PACARDO youth questionnaire, TOCA-R, and MAMBI can be obtained by sending an e-mail to the corresponding author.)

Key response variables and covariates of interest

Key response variables in this study report have been measured by PACARDO items on age at first drug exposure opportunity (e.g., "Regarding the drug marijuana, how old were you when you first had a chance to try marijuana?") and age at first actual drug

use (e.g., "How old were you when you first tried marijuana?"). These questions were asked about each drug of interest during modules 15 through 17 of the PACARDO questionnaire. In this report, valid age values given in response to these questions have been dichotomized to reflect ever/never experiences, coded as 1/0 responses. Participants who indicated that they had never experienced a chance to try the drug are coded "0" on the drug exposure opportunity variable, and those who reported a chance were coded as "1." Those who indicated that they had never used the drug were coded "0" on the drug use variable, and drug-using youths were coded "1." Drugs of interest are: alcoholic beverages, tobacco, inhalant drugs, and illegal or controlled drugs such as marijuana, crack, coca paste, heroin, and ecstasy. "Extramedical use" of tranquilizers was assessed by asking a Spanish translation of this question: "Regarding the drugs diazepam, alprazolam, *chicota*, or other tranquilizers, how old were you when you first had the opportunity to try tranquilizers or other sedatives for other than medical reasons?" (*Chicota* is a slang term for tranquilizers.)

Key covariates of interest are age (in years), sex, country, and private vs. public school type. Country is a multinomial variable, and public/private is a dichotomous variable, with values from an administrative database created by the survey team. For example, the assessors logged an entry for each school to indicate whether it was public or private. Checked against the Ministry of Education listing of schools, this variable was used in the following analyses. Sex (male/female) and age in years are from standardized self-report PACARDO items on these characteristics. Relationships between the PACARDO drug involvement constructs and the other PACARDO constructs listed in Table 3 will be the subject matter for future reports from our research group.

Data processing and quality control

After data collection, all survey data were keyed to disk, with 100% verification. This double-entry process was completed using a standardized Epi Info computer software (Centers for Disease Control and Prevention, Atlanta, Georgia, United States) database created and applied in all seven countries.

As in prior studies of youthful drug use, questions on a fake drug ("*Cadrina*") were included within the PACARDO questionnaire. Among the 12 797 respondents, only 0.7% reported an opportunity to use *Cadrina*, and 0.4% reported actually using this fake drug. In our reported epidemiological estimates we have excluded responses from these youths, under the assumption that misstatements about a fake drug may signal presence of falsely positive reports about other drug experiences or general response errors in the questionnaires completed by these participants. For this study report we have also excluded responses from the 2 youths who opted out of the survey by marking all responses as missing values and the 143 youths who opted out of all drug involvement responses.

Data analysis plan

For this report the epidemiological parameters of central interest involve two things: (a) the occurrence of youthful drug involvement and (b) school-level clustering of youthful drug involvement. Drug involvement encompasses the initial drug exposure opportunity as assessed via PACARDO self-report items on first chance to try each drug of interest as well as the actual use of each drug, assessed by corresponding PACARDO self-report items.

The occurrence of youthful drug involvement is gauged in relation to cumulative incidence (CI) within the life histories of the participants, up to and including the date of assessment. In drug research and psychiatric epidemiology this CI estimate is sometimes called "lifetime prevalence," but this term is somewhat misleading because a prevalence parameter can be affected directly by both the average incidence of an event or characteristic within a study base and the average duration of the event within the study base (18). In contrast, cumulative incidence (CI) of an event or characteristic in the study base is evaluated across the interval of each participant's life up to the date of assessment, and it is not at all influenced by the average duration of the event or characteristic during the span of the participant's life unless there is attrition due to high case fatality rates or similar removals from the population under study. It may be noteworthy that cumulative incidence of drug use for a study base defined in terms of a probability sample of school-attending youths may not be the same as cumulative incidence for a study base defined in terms of a cohort of zygotes after fertilization or in terms of a cohort of live births (19, 20). If drug exposure or drug use has caused or is otherwise associated with premature school-leaving or premature death, the CI estimate from the PACARDO survey will tend to be lower than the CI derived from a hypothetical follow-up of a specific conception cohort or birth cohort in the participating countries. We will return to this "limitation" of the PACARDO survey estimates in the discussion section of this report.

For this study, cumulative incidence has been estimated with 95% confidence bounds (CBs) derived by means of Taylor series linearization, as implemented via *svymean* procedures with the Stata software (StataCorp, College Station, Texas, United States). Cumulative incidence ratios (CIRs) have been estimated via odds ratios using a corresponding STATA *svylogit* procedure (e.g., to make cross-national comparisons in cumulative incidence, with covariate adjustment for age and sex). In most countries there were some missing responses to questions about drug use. We made CI estimates with two approaches: (1) with missing responses coded as "0," as if the youth had not used the drug; and (2) with missing responses excluded from both the numerator and the denominator of the CI. Only in Panama and in the Dominican Republic did this second approach yield appreciably different CI

TABLE 4. Selected demographic characteristics of the school-attending youth samples in the PACARDO study, 1999–2000

Country	No. of regions[a]	Schools	Public school		Age range		Boys		Girls		SND[c]		Total
			No.	(%)	(yr)	(mean)[b]	No.	(%)	No.	(%)	No.	(%)	No.
Panama	15	47	1 377	77.0	12–20	16.4	844	48.4	858	49.2	41	2.4	1 743
Costa Rica	11	51	1 377	80.9	10–23	16.3	786	46.2	899	52.8	17	1.0	1 702
Nicaragua	11	46	1 031	72.7	11–20	16.4	639	45.0	764	53.9	16	1.1	1 419
Honduras	11	47	1 067	60.9	13–20	15.8	680	38.8	1 072	61.2	0	0.0	1 752
El Salvador	14	51	1 268	77.9	12–20	16.0	913	56.1	702	43.1	13	0.8	1 628
Guatemala	11	63	1 247	49.3	11–23	15.6	1 302	51.5	1 178	46.5	50	2.0	2 530
Dominican Republic	24	59	1 386	68.5	12–31	15.9	883	43.7	1 102	54.4	39	1.9	2 023
Tota/Overall	97	364	8 753	68.4	10–31	16.0	6 047	47.2	6 574	51.4	176	1.4	12 797

[a] "Region" refers to departments or provinces.
[b] The high age values in the ranges are due to inclusion of a few adults within samples of school-attending youths (e.g., adults seeking literacy while attending evening Spanish language classes for adolescents).
[c] SND = sex not determined, that is, where student did not mark the male/female response on the questionnaire.

estimates. Therefore, in our table we have reported CI estimates from the first approach only, but in the footnote to the table we have provided the estimates for Panama and the Dominican Republic wherever we found appreciable differences.

Clustering of drug involvement has been gauged in the form of the pairwise cross-product ratio estimate from the alternating logistic regressions, a procedure devised by V. Carey in an elaboration of the generalized estimating equations methods developed by K.Y. Liang and S. Zeger (21–25). In a series of recent contributions published in the *American Journal of Epidemiology*, the *Journal of Epidemiology and Community Health*, and elsewhere our research group has described this novel approach to epidemiological investigations on nonrandom clustering of health-related events and characteristics, and has provided a detailed introduction to the alternating logistic regressions (ALRs) and the pairwise cross-product ratio (PWCPR, also known as the pairwise odds ratio, PWOR), as estimated using ALR methods (2, 26–30). In brief, analogous to the contrast between a household-level conditional probability or secondary attack rate versus a communitywide unconditional attack rate, our PWCPR estimates indicate whether there is a nonrandom clustering of drug involvement within schools of each country, with co-occurrence of drug involvement among youths who are sampled within the same schools of a country as compared to co-occurrence of drug involvement by youths sampled from different schools within that country. As with the null value of 1.0 for an odds ratio or a cross-product ratio from a 2×2 table, a PWCPR estimate exceeding the null value of 1.0 is a signal of nonrandom clustering of drug involvement within schools. This nonrandom clustering may reflect person-to-person diffusion of drug involvement or "social contagion" processes, as discussed recently by Petronis and Anthony (30). The ALR estimation procedures for this study have been implemented using the PROC GENMOD command of the SAS System software (Version 8.2, from the SAS Institute, Carey, North Carolina, United States), which yields generalized estimating equation solutions and estimates of the PWCPR and its 95% CB.

RESULTS

Table 4 provides a description of the nationally representative sample of the 12 797 school-attending adolescents, aggregated across the seven PACARDO countries, as well as descriptions of the study sample within each participat-ing country. As shown in Table 4, the 12 797 students were almost evenly split between males and females. Honduras had the highest female representation, 61%, and El Salvador had the lowest female representation, 43%. The mean student age for all countries was 16.0 years. About 76% of the sample was within the target age of 15–17 years, and 93% of the sample was between 14 and 18 years of age.

Tables 5 and 6 present estimates and 95% confidence bounds (CBs) for the cumulative incidence of experience with each of the major drug groups under study, specific for each of the seven PACARDO countries. Alcohol is the most commonly used drug. At the high end, an estimated 81% of youths in the Dominican Republic reported having consumed alcoholic beverages at least once. In contrast, an estimated 34% of youths in El Salvador reported drinking. Tobacco was the next most used drug but had considerably lower cumulative incidence estimates: e.g., 47% of youth in Costa Rica had smoked tobacco at least once, as compared to 20% in Panama.

The next most commonly used drug was either marijuana or an inhalant drug such as cobbler's glue or gasoline or diesel fuel. In Guatemala, Nicaragua, and Panama there were essentially comparable CI estimates for use of marijuana and use of inhalants. That is to say, within each country, the 95% confidence bounds for the marijuana and inhalants CI estimates had an overlap. In Costa Rica and El Salvador, marijuana CI estimates were higher than those for inhalant use. Conversely, in the Dominican Repub-

TABLE 5. Summary table of estimated cumulative incidence (CI) and 95% confidence bounds (CBs) for drug involvement in the PACARDO study, 1999–2000[a]

	Panama (*n* = 1 743)	Costa Rica (*n* = 1 702)	Nicaragua (*n* = 1 419)	Honduras (*n* = 1 752)	El Salvador (*n* = 1 628)	Guatemala (*n* = 2 530)	Dominican Republic (*n* = 2 023)	Total (*n* = 12 797)
Alcohol								
Exposure opportunity, CI	0.61	0.76	0.60	0.58	0.38	0.30	0.85	0.58
95% CB	(0.58, 0.64)	(0.74, 0.78)	(0.57, 0.63)	(0.55, 0.62)	(0.35, 0.41)	(0.28, 0.33)	(0.83, 0.87)	(0.57, 0.59)
Actual use, CI	0.56	0.72	0.49	0.49	0.34	0.26	0.81	0.52
95% CB	(0.53, 0.59)	(0.70,0.74)	(0.46, 0.52)	(0.46, 0.52)	(0.32, 0.37)	(0.24, 0.28)	(0.78, 0.83)	(0.51, 0.53)
Tobacco								
Exposure opportunity, CI	0.22	0.56	0.43	0.43	0.32	0.24	0.40	0.37
95% CB	(0.19, 0.25)	(0.53, 0.59)	(0.40, 0.46)	(0.40, 0.46)	(0.29, 0.34)	(0.22, 0.27)	(0.37, 0.43)	(0.36, 0.38)
Actual use, CI	0.20	0.47	0.34	0.33	0.30	0.22	0.23	0.29
95% CB	(0.18, 0.23)	(0.44, 0.50)	(0.31, 0.37)	(0.30, 0.35)	(0.28, 0.32)	(0.19, 0.24)	(0.20, 0.25)	(0.28, 0.30)
Inhalants								
Exposure opportunity, CI	0.04	0.09	0.11	0.19	0.05	0.04	0.25	0.13
95% CB	(0.03, 0.05)	(0.08, 0.11)	(0.09, 0.13)	(0.16, 0.22)	(0.04, 0.07)	(0.03, 0.05)	(0.22, 0.27)	(0.12, 0.13)
Actual use, CI	0.02	0.06	0.04	0.05	0.04	0.02	0.11	0.05
95% CB	(0.02, 0.03)	(0.04, 0.07)	(0.03, 0.05)	(0.04, 0.06)	(0.03, 0.05)	(0.02, 0.03)	(0.10, 0.13)	(0.05, 0.06)
Any illegal drug								
Exposure opportunity, CI	0.05	0.21	0.15	0.13	0.11	0.06	0.11	0.11
95% CB	(0.04, 0.07)	(0.18, 0.23)	(0.13, 0.17)	(0.12, 0.15)	(0.09, 0.12)	(0.05, 0.07)	(0.90, 0.12)	(0.11, 0.12)
Actual use, CI	0.04	0.1	0.06	0.04	0.08	0.04	0.03	0.05
95% CB	(0.03, 0.05)	(0.08, 0.11)	(0.05, 0.07)	(0.03, 0.05)	(0.07, 0.10)	(0.03, 0.05)	(0.02, 0.04)	(0.05, 0.06)

[a] In Panama, cumulative incidence for alcohol use is 0.64 (0.57, 0.70) and for tobacco use 0.24 (0.19, 0.28) when missing responses are not included in the analysis. In the Dominican Republic, when missing responses are not included in the analysis, estimates for alcohol opportunity and use are 0.89 (0.86, 0.93) and 0.85 (0.82, 0.88), respectively; estimates for cumulative incidence of tobacco exposure opportunity and actual use are 0.48 (0.41, 0.55) and 0.27 (0.23, 0.32); and estimates for inhalant exposure opportunity and use are 0.34 (0.28, 0.39) and 0.16 (0.13, 0.18).

TABLE 6. Summary table of estimated cumulative incidence (CI) and 95% confidence bounds (CBs) for illegal drug involvement in the PACARDO study, 1999–2000

	Panama (*n* = 1 743)	Costa Rica (*n* = 1 702)	Nicaragua (*n* = 1 419)	Honduras (*n* = 1 752)	El Salvador (*n* = 1 628)	Guatemala (*n* = 2 530)	Dominican Republic (*n* = 2 023)	Total (*n* = 12 797)
Marijuana								
Exposure opportunity, CI	0.04	0.19	0.11	0.11	0.09	0.05	0.07	0.09
95% CB	(0.03, 0.06)	(0.16, 0.21)	(0.09, 0.12)	(0.09, 0.12)	(0.07, 0.10)	(0.04, 0.06)	(0.06, 0.08)	(0.08, 0.09)
Actual use, CI	0.03	0.10	0.05	0.03	0.07	0.03	0.02	0.04
95% CB	(0.02, 0.04)	(0.08, 0.11)	(0.04, 0.07)	(0.02, 0.04)	(0.06, 0.09)	(0.03, 0.04)	(0.01, 0.02)	(0.04, 0.05)
Crack/coca paste								
Exposure opportunity, CI	0.01	0.03	0.04	0.04	0.03	0.02	0.04	0.03
95% CB	(0.01, 0.02)	(0.02, 0.04)	(0.03, 0.05)	(0.03, 0.05)	(0.02, 0.04)	(0.01, 0.02)	(0.03, 0.05)	(0.03, 0.03)
Actual use, CI	0.004	0.01	0.01	0.01	0.02	0.01	0.01	0.01
95% CB	(0.001, 0.007)	(0.005, 0.014)	(0.01, 0.02)	(0.01, 0.02)	(0.02, 0.03)	(0.005, 0.013)	(0.01, 0.02)	(0.01, 0.01)
Ecstasy								
Exposure opportunity, CI	0.01	0.02	0.01	0.002	0.01	0.01	0.02	0.01
95% CB	(0.004, 0.014)	(0.01, 0.02)	(0.004, 0.013)	(0.000, 0.004)	(0.01, 0.02)	(0.01, 0.01)	(0.02, 0.03)	(0.01, 0.01)
Actual use, CI	0.005	0.007	0.002	0.001	0.01	0.004	0.007	0.005
95% CB	(0.002, 0.008)	(0.003, 0.010)	(0.000, 0.005)	(0.000, 0.003)	(0.01, 0.02)	(0.002, 0.007)	(0.003, 0.010)	(0.004, 0.006)
Methamphetamines and amphetamines								
Actual use, CI	0.01	0.02	0.04	0.03	0.02	0.01	0.01	0.02
95% CB	(0.003, 0.012)	(0.02, 0.03)	(0.03, 0.05)	(0.02, 0.04)	(0.02, 0.03)	(0.01, 0.01)	(0.01, 0.02)	(0.02, 0.02)
Tranquilizersa								
Actual use, CI	0.02	0.04	0.15	0.09	0.02	0.05	0.06	0.08
95% CB	(0.01, 0.02)	(0.03, 0.05)	(0.13, 0.18)	(0.07, 0.10)	(0.02, 0.03)	(0.04, 0.05)	(0.05, 0.07)	(0.07, 0.08)
Heroin								
Exposure opportunity, CI	0.01	0.02	0.01	0.01	0.02	0.01	0.03	0.02
95% CB	(0.004, 0.013)	(0.01, 0.02)	(0.005, 0.016)	(0.01, 0.02)	(0.01, 0.02)	(0.005, 0.013)	(0.02, 0.03)	(0.01, 0.02)
Actual use, CI	0.004	0.005	0.006	0.003	0.012	0.007	0.010	0.007
95% CB	(0.001, 0.007)	(0.002, 0.010)	(0.002, 0.011)	(0.001, 0.006)	(0.006, 0.017)	(0.004, 0.100)	(0.006, 0.014)	(0.005, 0.008)

[a] To reduce respondent burden, exposure opportunity items were not asked about these drugs.

lic and Honduras, CI estimates for inhalant use were higher than CI estimates for marijuana use.

The aggregate response for "any illegal drug involvement" was defined as exposure opportunity or use of marijuana, crack/coca paste, ecstasy (methylenedioxymethamphetamine, or MDMA), methamphetamines, or heroin. Possibly the most interesting of the estimates on illegal drug use can be seen in relation to estimated transition probabilities in the sequence from a chance to try the drug to actual drug use. The conditional probability of making a transition to use once opportunity has occurred are estimated as 90% for alcohol and as 80% for tobacco. For illegal drugs the conditional probabilities estimates are much lower: 48% overall, with a range from 52% for marijuana to 38% for crack/coca paste.

Investigators on our study team did not expect to find much exposure opportunity nor actual use of ecstasy or heroin: 66 ecstasy users and 87 heroin users were found in this sample. There was a large span in the CI estimates for extramedical use of tranquilizers, ranging from 2% in Panama to 15% in Nicaragua.

Tables 7 and 8 show the results of the multiple logistic regression analyses and provide summary estimates for the strength of the association between drug involvement and demographic features. Overall, boys were more likely to have used all drugs except for methamphetamines, where no sex differences were found (that is, in this instance, the associated P value is 0.05 or greater, and in addition the 95% confidence bounds trapped the null value of 1.0). Boys were less likely than females to report extramedical tranquilizer use. Younger students, that is, those 10 to 14 years old, were less likely to report use of some drugs, as compared to students 15 to 17 years old. However, with respect to inhalants, ecstasy, methamphetamines, and tranquilizers, there was no age-related variation in this contrast of younger and middle adolescents (here, $P > 0.05$). Youths who were 18 years of age or older were more likely to use all of the drugs except for alcohol, tobacco, and inhalants, where no differences were found (here again, $P > 0.05$). Private school attendance was associated with larger CI estimates for use of alcohol, tobacco, marijuana, and crack/coca paste (all $P < 0.05$), but not for inhalants, ecstasy, methamphetamines/amphetamines, and tranquilizers, where no differences between public and private schools were found (i.e., $P > 0.05$ and the 95% CB entrapped the null value of 1.0).

Figure 1 presents evidence on the magnitude and precision of our study estimates on school-level clustering of drug involvement, as reflected in point estimates for the pairwise cross-product ratios (PWCPRs) from the alternating logistic regressions as well as 95% confidence bounds. There was noteworthy school-level clustering of alcohol use as well as tobacco use: all PWCPR estimates and lower 95% confidence bounds are above the null PWCPR value of 1.0 (Figure 1), and the associated P values all met the conventional standard for statistical significance of an estimate (i.e., $P < 0.05$, P values not shown in the figure). In contrast, for only two countries was there evidence of school-level clustering of inhalant drug use, although all point estimates were above the null value of 1.0. In Costa Rica and in the Dominican Republic, the P values associated with the PWCPRs were statis-

TABLE 7. Estimated association (odds ratios (ORs) and 95% confidence bounds (CBs)) between drug exposure opportunity and selected demographic characteristics of the student samples in the PACARDO study, 1999–2000[a,b]

	Alcohol	Tobacco	Inhalants	Marijuana	Crack/coca paste	Ecstasy	Any illegal drug
Sex							
Female	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Male, OR	1.33	1.97	1.28	2.69	2.00	1.95	2.10
95% CB	(1.19, 1.48)	(1.77, 2.19)	(1.10, 1.48)	(2.26, 3.20)	(1.55, 2.56)	(1.38, 2.75)	(1.82, 2.43)
	$P < 0.001$	$P < 0.001$	$P = 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Age category							
10–14 years, OR	0.48	0.50	0.66	0.27	0.48	0.48	0.37
95% CB	(0.38, 0.60)	(0.40, 0.62)	(0.49, 0.89)	(0.18, 0.41)	(0.30, 0.77)	(0.21, 1.11)	(0.27, 0.50)
	$P < 0.001$	$P < 0.001$	$P = 0.007$	$P < 0.001$	$P = 0.002$	$P = 0.09$	$P < 0.001$
15–17 years	1.00	1.00	1.00	1.00	1.00	1.00	1.00
≥ 18 years, OR	1.00	0.93	0.85	1.24	1.45	1.51	1.28
95% CB	(0.84, 1.19)	(0.80, 1.08)	(0.69, 1.06)	(1.02, 1.51)	(1.05, 1.99)	(0.94, 2.41)	(1.07, 1.53)
	$P = 0.96$	$P > 0.05$	$P = 0.15$	$P = 0.03$	$P = 0.03$	$P = 0.09$	$P = 0.007$
Type of school							
Public	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Private, OR	1.62	1.69	1.05	1.55	1.70	1.85	1.50
95% CB	(1.27, 2.06)	(1.39, 2.07)	(0.78, 1.40)	(1.23, 1.95)	(1.27, 2.27)	(1.25, 2.74)	(1.22, 1.85)
	$P < 0.001$	$P < 0.001$	$P = 0.75$	$P < 0.001$	$P < 0.001$	$P = 0.002$	$P < 0.001$

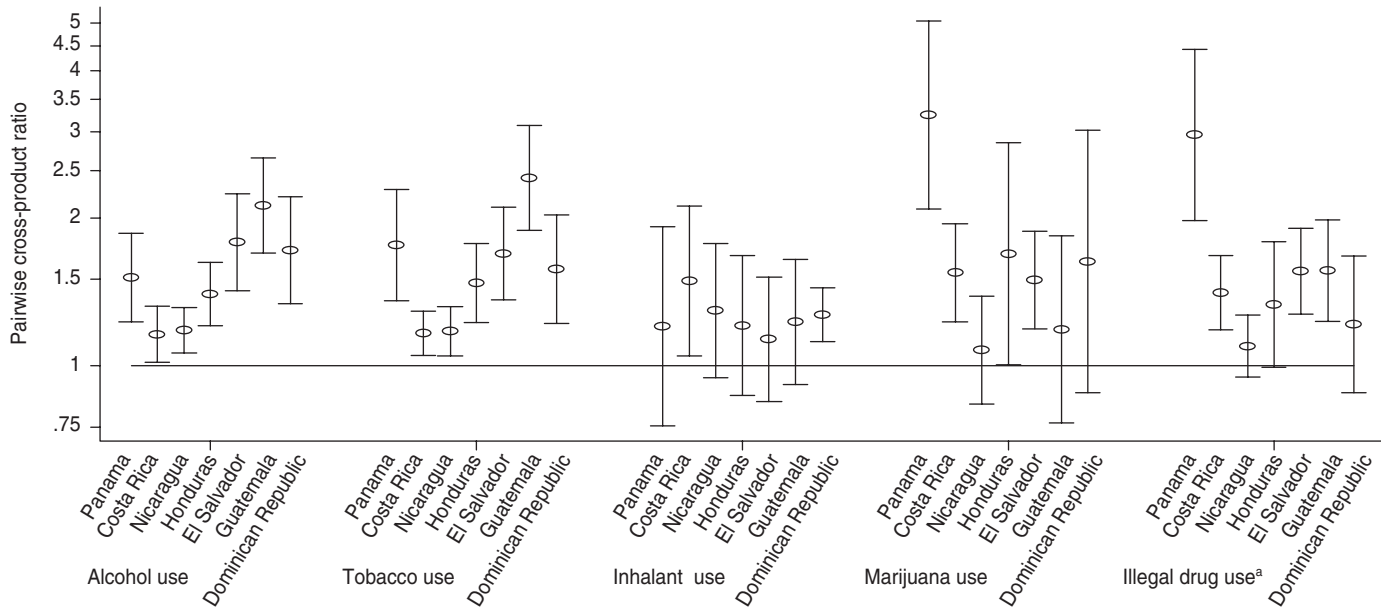
[a] Reference categories are designated with odds ratio estimates of 1.00. Read the table values column by column, top to bottom.
[b] Estimates are not presented for methamphetamine/amphetamines or tranquilizers because exposure opportunity questions were not asked about these drugs.

TABLE 8. Estimated association (odds ratios (ORs) and 95% confidence bounds (CBs)) between drug use and selected demographic characteristics of the student samples in the PACARDO study, 1999–2000[a]

	Alcohol	Tobacco	Inhalants	Marijuana	Crack/coca paste	Ecstasy	Meth/ amphetamine	Tranquilizers	Any illegal drug
Sex									
Female	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Male, OR	1.33	2.09	1.56	4.08	3.48	2.46	1.12	0.82	3.17
95% CB	(1.20, 1.48)	(1.88, 2.34)	(1.30, 1.85)	(3.20, 5.20)	(2.22, 5.30)	(1.43, 4.23)	(0.86, 1.45)	(0.70, 0.96)	(2.57, 3.92)
	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P = 0.40$	$P = 0.01$	$P < 0.001$
Age category									
10–14 years, OR	0.55	0.47	0.87	0.25	0.42	0.46	0.58	0.78	0.36
95% CB	(0.44, 0.68)	(0.39, 0.56)	(0.63, 1.22)	(0.14, 0.43)	(0.18, 0.98)	(0.13, 1.57)	(0.33, 0.99)	(0.57, 1.06)	(0.23, 0.55)
	$P < 0.001$	$P < 0.001$	$P = 0.42$	$P < 0.001$	$P = 0.04$	$P = 0.21$	$P = 0.04$	$P = 0.11$	$P < 0.001$
15–17 years	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
≥ 18 years, OR	1.04	1.06	1.04	1.99	1.79	2.20	1.67	1.47	1.81
95% CB	(0.88, 1.22)	(0.93, 1.21)	(0.81, 1.35)	(1.58, 2.50)	(1.18, 2.70)	(1.21, 4.03)	(1.16, 2.41)	(1.20, 1.81)	(1.45, 2.26)
	$P = 0.64$	$P = 0.41$	$P = 0.74$	$P < 0.001$	$P = 0.01$	$P = 0.01$	$P = 0.01$	$P = 0.03$	$P < 0.001$
Type of school									
Public	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Private, OR	1.68	1.73	1.01	1.60	1.70	1.73	1.24	1.13	1.55
95% CB	(1.33, 2.12)	(1.45, 2.07)	(0.78, 1.31)	(1.26, 2.04)	(1.13, 2.56)	(1.00, 3.00)	(0.87, 1.77)	(0.90, 1.41)	(1.25, 1.94)
	$P < 0.001$	$P < 0.001$	$P = 0.93$	$P < 0.001$	$P = 0.01$	$P = 0.04$	$P = 0.23$	$P = 0.30$	$P < 0.001$

[a] Reference categories are designated with odds ratio estimates of 1.00. Read the table values column by column, top to bottom.

FIGURE 1. Estimated pairwise cross-product ratios and confidence bounds of school-level clustering of drug use in the PACARDO study, 1999–2000



[a]Defined to include marijuana, crack/coca paste cocaine, ecstasy, and heroin use.

tically significant by conventional standards (i.e., $P < 0.05$) and the 95% confidence bounds did not entrap the null value of 1.0.

With respect to marijuana, there was evidence of school-level clustering in three countries—Panama, Costa Rica, and El Salvador—as gauged by conventional standards of statistical significance (i.e., $P < 0.05$). The clustering estimate for El Salvador was 1.5, whereas in Panama it was just above

3.0. When all illegal drug use was grouped into a single category, there was noteworthy school-level clustering of illegal drug use in Panama, El Salvador, and Guatemala. Point estimates for the PWCPR values were above the null value of 1.0 for all of the other countries, but in these instances, the 95% confidence bounds entrapped the null value, and the associated *P* value was greater than 0.05 (*P* values not shown in the figure).

DISCUSSION

The main findings of this cross-national study of school-attending youths in the PACARDO countries are summarized in the following six paragraphs.

First, there is substantial country-to-country variation in the estimated cumulative incidence of alcohol involvement. When all PACARDO youths are aggregated, more than one-half of these youths have had a chance to try alcoholic beverages, and an estimated 51%–53% actually have consumed alcoholic beverages at least once. The largest estimates are from the Dominican Republic, where 83%–87% have had the chance to try alcohol, and almost as many have actually consumed alcohol. The smallest estimates are from Guatemala, where 28%–33% have had a chance to try alcohol, and 24%–28% have consumed alcohol. As noted in Table 9, logistic regression analysis with covariate adjustment for age (in years), sex (male/female), and school type (public/private) confirms that these country-to-country variations cannot be understood as artifacts of imbalanced samples with respect to these variables. The smallest association (odds ratio estimate) for alcohol use was 1.9 (El Salvador), with Guatemala as a reference. The largest association for alcohol use was 15.9 (Dominican Republic), also with Guatemala as a reference. As shown in Figure 1, estimates of school-level clustering indicated that alcohol use clusters nonrandomly within schools in all of the PACARDO countries. The largest clustering point estimate is observed in Guatemala, and the smallest clustering estimate is observed in Costa Rica.

A second major finding is that youthful tobacco involvement occurs less often than youthful alcohol involvement in all of the PACARDO countries. There is country-by-country variation in cumulative incidence of exposure opportunity and actual use. The largest estimates are from Costa Rica, where 53%–59% have had a chance to try tobacco, and almost as many have actually used tobacco at least once. The smallest estimates are from Panama, where 19%–25% have had a tobacco exposure opportunity, and 18–23% have consumed tobacco at least once. Logistic regression analyses indicate country-to-country variation in exposure opportunity and actual use. For example, with the experience of youths in Guatemala as a reference, tobacco exposure opportunity and tobacco use occur four to six times more often in Costa Rica. Whereas pilot studies had indicated a lower occurrence of tobacco smoking in the Dominican Republic than in El Salvador as compared to the other countries investigated, this was not the case in the present study. Here, with more rigorous adherence to a common cross-national sampling and survey protocol, we find that youths in El Salvador are more likely to have started smoking tobacco as compared to those in Guatemala. Youths in the Dominican Republic are just as likely to have started smoking tobacco as are their counterparts in Guatemala. Notwithstanding these variations in cumulative occurrence of tobacco smoking among youths, as depicted in Figure 1, tobacco smoking experience has a nonrandom school-level clustering in all seven PACARDO countries. The largest point estimates for school-level clustering are observed in Guatemala, and the smallest clustering estimates are observed in Costa Rica and Nicaragua.

Third, with respect to exposure opportunity and use of inhalant drugs such as glues and fuels, cumulative incidence estimates are largest for the Dominican Republic and Honduras, and they are smallest for Panama and Guatemala. In the seven PACARDO countries as a whole, an estimated 12%-13% of school-attending youths have experienced a chance to try inhalant drugs, while an estimated 5% have engaged in inhalant drug use on at least one occasion. It is noteworthy that in Honduras an estimated 16%-22% of youths have had a chance to try inhalants but only about 5% have actually experimented with inhalants. We cannot say whether this "resistance" to the opportunity to try inhalant drugs has been induced by an aggressive anti-inhalants campaign in Honduras, although we are aware of considerable newspaper coverage and publicity given to street kids' usage of the cobbler's glue marketed as *Resistol* in that country, as well as other commercially available volatile substances. With respect to school-level clustering of inhalant drug use, we found nonrandom clustering of inhalant drug use in Costa Rica (PWCPR = 1.5; 95% CB = 1.1–2.1) and in the Dominican Republic (PWCPR = 1.3; 95% CB = 1.1–1.4), but not elsewhere.

Fourth, with respect to illegal drug involvement, we find that marijuana exposure opportunity and marijuana use are present but not widespread. In the PACARDO countries overall, an estimated 8%–9% (that is, one in 11) of the school-attending youths have had a chance to try marijuana, and about 4%–5% (or one in 20–25) of the youths have actually engaged in marijuana use on at least one occasion. Estimates for Costa Rica are about double these values, a magnitude of variation that cannot be explained by between-country imbalances with respect to age, sex, or type of school. The highest estimates of nonrandom school-level clustering were found for marijuana use in Panama (PWCPR = 3.3; 95% CB = 2.1–5.0). Tangible clustering was also found in Costa Rica and in El Salvador, (for both, PWCPR = 1.5; 95% CB = 1.2–1.9); in the rest of the PACARDO countries, the PWCPR estimates trap the null value of 1.0.

Fifth, relative to what has been observed for alcohol, tobacco, inhalant drugs, and marijuana, the chances to try and the actual use of other illegal

TABLE 9. Estimated association as gauged by cumulative incidence ratios (CIRs) and 95% confidence bounds (CBs) between drug exposure opportunity and drug use, for each country in the PACARDO study, with Guatemala as a reference, 1999–2000[a]

	Guatemala (n = 2 530)	Panama (n = 1 743)	Costa Rica (n = 1 702)	Nicaragua (n = 1 419)	Honduras (n = 1 752)	El Salvador (n = 1 628)	Dominican Republic (n = 2 023)
Alcohol							
Exposure opportunity, CIR	1.00	4.82	10.20	4.52	3.96	1.79	17.29
95% CB	—	(3.56, 6.53)	(7.59, 13.70)	(3.43, 5.97)	(2.85, 5.48)	(1.32, 2.44)	(12.17, 24.57)
	—	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Actual use, CIR	1.00	5.01	10.53	3.59	3.29	1.94	15.89
95% CB	—	(3.76, 6.68)	(8.01, 13.83)	(2.73, 4.72)	(2.46, 4.40)	(1.43, 2.63)	(11.57, 21.83)
	—	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Tobacco							
Exposure opportunity, CIR	1.00	1.07	5.34	3.05	2.92	1.75	2.58
95% CB	—	(0.76, 1.50)	(3.96, 7.21)	(2.25, 4.15)	(2.05, 4.16)	(1.25, 2.43)	(1.83, 3.63)
	—	$P = 0.08$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Actual use, CIR	1.00	1.15	4.41	2.42	2.16	1.92	1.28
95% CB	—	(0.83, 1.60)	(3.32, 5.87)	(1.80, 3.24)	(1.57, 2.98)	(1.39, 2.67)	(0.94, 1.76)
	—	$P = 0.38$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P = 0.12$
Inhalants							
Exposure opportunity, CIR	1.00	0.98	2.52	3.14	5.98	1.43	8.34
95% CB	—	(0.66, 1.46)	(1.76, 3.59)	(2.06, 4.79)	(3.95, 9.05)	(1.01, 2.01)	(6.17, 11.26)
	—	$P = 0.85$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Actual use, CIR	1.00	1.01	2.59	1.61	2.09	1.81	5.49
95% CB	—	(0.66, 1.57)	(1.73, 3.86)	(1.05, 2.46)	(1.41, 3.10)	(1.24, 2.66)	(3.93, 7.67)
	—	$P = 0.98$	$P < 0.001$	$P = 0.02$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Any illegal drug							
Exposure opportunity, CIR	1.00	0.89	4.31	2.84	2.74	1.77	1.94
95% CB	—	(0.55, 1.44)	(3.15, 5.91)	(2.04, 3.95)	(1.90, 3.95)	(1.25, 2.50)	(1.36, 2.79)
	—	$P = 0.37$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Actual use, CIR	1.00	1.05	3.23	1.78	1.41	2.32	0.87
95% CB	—	(0.64, 1.73)	(2.20, 4.73)	(1.23, 2.58)	(0.90, 2.20)	(1.59, 3.41)	(0.58, 1.32)
	—	$P = 0.79$	$P < 0.001$	$P < 0.001$	$P = 0.06$	$P < 0.001$	$P = 0.38$
Marijuana							
Exposure opportunity, CIR	1.00	1.14	6.24	2.98	3.13	2.32	1.89
95% CB	—	(0.68, 1.93)	(4.44, 8.76)	(2.04, 4.34)	(2.10, 4.66)	(1.62, 3.34)	(1.27, 2.80)
	—	$P = 0.75$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Actual use, CIR	1.00	1.33	4.69	2.18	1.47	2.86	0.65
95% CB	—	(0.79, 2.22)	(3.19, 6.91)	(1.48, 3.21)	(0.92, 2.36)	(1.95, 4.20)	(0.40, 1.07)
	—	$P = 0.72$	$P < 0.001$	$P < 0.001$	$P = 0.14$	$P < 0.001$	$P = 0.06$
Crack/coca paste							
Exposure opportunity, CIR	1.00	0.59	1.93	2.15	2.28	1.57	2.37
95% CB	—	(0.33, 1.08)	(1.23, 3.03)	(1.26, 3.67)	(1.32, 3.94)	(1.04, 2.44)	(1.52, 3.69)
	—	$P = 0.06$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P = 0.03$	$P < 0.001$
Actual use, CIR	1.00	0.49	1.27	1.73	1.59	2.85	1.35
95% CB	—	(0.19, 1.27)	(0.62, 2.57)	(0.77, 3.51)	(0.72, 3.51)	(1.53, 5.32)	(0.68, 2.70)
	—	$P = 0.10$	$P = 0.50$	$P = 0.09$	$P = 0.17$	$P < 0.001$	$P = 0.34$
Ecstasy							
Exposure opportunity, CIR	1.00	0.88	1.87	0.89	0.19	1.49	2.3
95% CB	—	(0.34, 2.29)	(1.05, 3.35)	(0.39, 2.03)	(0.06, 0.63)	(0.79, 2.81)	(1.39, 3.80)
	—	$P = 0.70$	$P = 0.02$	$P = 0.74$	$P = 0.006$	$P = 0.17$	$P < 0.001$
Actual use, CIR	1.00	1.13	1.7	0.52	0.33	2.57	1.63
95% CB	—	(0.46, 2.77)	(0.72, 4.03)	(0.14, 1.90)	(0.07, 1.49)	(1.15, 5.73)	(0.70, 3.80)
	—	$P = 0.82$	$P = 0.24$	$P = 0.32$	$P = 0.14$	$P = 0.01$	$P = 0.24$
Methamphetamines and amphetamines							
Actual use, CIR	1.00	0.74	2.52	4.37	3.51	2.21	1.37
95% CB	—	(0.38, 1.47)	(1.26, 5.05)	(2.59, 7.38)	(1.93, 6.37)	(1.23, 3.99)	(0.74, 2.52)
	—	$P = 0.36$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P = 0.002$	$P = 0.26$
Tranquilizers							
Actual use, CIR	1.00	0.4	0.92	3.78	2.04	2.2	1.36
95% CB	—	(0.26, 0.63)	(0.62, 1.38)	(2.83, 5.04)	(1.51, 2.77)	(1.60, 3.02)	(1.05, 1.90)
	—	$P < 0.001$	$P = 0.61$	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P = 0.02$
Heroin							
Opportunity, CIR	1.00	1.21	2.37	1.4	1.94	2.11	3.45
95% CB	—	(0.63, 2.36)	(1.33, 4.22)	(0.72, 2.70)	(1.09, 3.47)	(1.19, 3.73)	(2.09, 5.69)
		$P = 0.57$	$P = 0.003$	$P = 0.32$	$P = 0.03$	$P = 0.01$	$P < 0.001$
Actual use, CIR	1.00	0.72	0.99	1.09	0.61	1.96	1.71
95% CB	—	(0.29, 1.76)	(0.43, 2.28)	(0.48, 2.46)	(0.24, 1.58)	(1.00, 3.84)	(0.88, 3.29)
	—	$P = 0.47$	$P = 0.98$	$P = 0.84$	$P = 0.31$	$P = 0.05$	$P = 0.11$

[a] Guatemala's sample serves as a reference against which the other samples are compared. Read the table from left to right, row by row. When the CIR estimate is not different from 1.0, the cumulative incidence in the listed country is not appreciably different from the cumulative incidence in Guatemala. When the CIR is greater than 1.0, the cumulative incidence in the listed country is appreciably larger than the cumulative incidence in Guatemala. When the CIR is less than 1.0, the cumulative incidence in the listed country is appreciably smaller than is the cumulative incidence in Guatemala.

drugs are much less common in the PACARDO countries. Cumulative incidence estimates for crack/coca paste use ranged from below 1% in Panama to the 1%–2% range in all other of the seven participating countries.

Sixth, the estimated occurrence of extramedical use of tranquilizers varied a great deal between countries, with the CB estimates as high as 13%–18% in Nicaragua, and as low as 1%–2% in Panama. Tranquilizers represent one drug group that girls were more likely to use extramedically than were boys.

There are several issues that merit attention. First, since this study involves samples of school-attending youths, caution is required before generalization to all adolescents. The rate of youth leaving school before age 16 varies among the participating countries. This variation makes cross-national comparisons more difficult. As discussed elsewhere, the assessment of drug use also has its limitations; we must consider possible overreporting or underreporting by various subpopulations (31, 32).

Youths not in school were excluded from the sampling frames of the PACARDO research project. Nonetheless, as in other countries, such as the United States, there is good reason to study the drug involvement of school-attending youths in the PACARDO countries. For example, as mentioned in the introduction section of this article, it is most likely that the future leadership of these countries will be drawn from among youths who remain in school during their adolescent years. In the United States the Monitoring the Future (MTF) survey has examined drug-taking and related behaviors, attitudes, and values of secondary school students in that country since 1975 (33, 34). The European School Survey Project on Alcohol and Other Drugs (ESPAD) examines drug-taking behaviors of secondary school students who are 15–16 years old, collecting comparable data on alcohol, tobacco, and other drug use. Used together, the MTF data and the ESPAD data make it possible to compare trends between countries (35). The Global Youth Tobacco Survey (GYTS) is another school-based survey that assesses tobacco use and exposure to tobacco among youth (ages 13 to 15 years) (8, 9, 36). The drug surveillance data generated by the PACARDO research project adds to the body of public health evidence already provided by MTF, ESPAD, and GYTS for the more established market economies of the world.

Notwithstanding limitations such as these, this study has a number of counterbalancing strengths, including the fact that the PACARDO research project represents a first attempt to use the same methods for cross-national studies of both legal and illegal drug involvement among adolescents in Latin American countries. To reduce nonresponse bias, extra attempts were made to include absentees. Except when prevented by extenuating circumstances, project staff returned to the school to assess students who had been absent the day of the assessment. However, a bias may still exist as students absent on all days of assessment are excluded from the analysis, and their absence may be the result of heavier drug use. Future analysis of the TOCA-R ratings by classroom teachers will help clarify the differences between the youths who were present and those who were absent.

In relation to school survey findings from other countries as disclosed in the 1999 MTF and ESPAD reports, our study's estimates suggest that overall drug use is generally lower in the PACARDO countries. For example, the cumulative incidence estimate for alcohol use among tenth graders observed for the United States was 70%, versus an estimate of 51% found in the PACARDO survey; no comparable ESPAD estimates have been published. In the PACARDO survey we found that 29% of school-attending youths had smoked tobacco at least once. The corresponding estimate from the MTF is 59%. Estimates from GYTS ranged a great deal: overall, for youths in all the GYTS countries, approximately 33% of youths in the age range of 13 to 15 years had sampled tobacco. The highest estimates of the cumulative incidence of youth who had ever smoked tobacco, around 80%, were in the Northern Marianas Islands; the lowest estimates, around 4%, were in the state of Tamil Nadu, India. In Latin America the highest estimates of ever having smoked tobacco were in Chile, and ranged from 68% in the city of Valparaiso to 72% in the city of Santiago. In Uruguay, estimates ranged from 39% in the city of Colonia to as high as 57% in the city of Montevideo. In the city of Buenos Aires, Argentina, 55% of youth had sampled tobacco. In Peru, estimates ranged from 46% in the city of Trujillo to 55% in the city of Lima. In Bolivia, estimates ranged from 54% in the city of Santa Cruz to 50% in the city of Cochabamba. Lower estimates were found in Venezuela (22%) and in Cuba (34%). The GYTS estimates for the country of Costa Rica are somewhat lower than those found in the PACARDO survey (44% versus 56%); however, this variation might be expected, given that the mean age of the youth in the PACARDO survey was 16 years versus the younger ages of youth surveyed in the GYTS (8, 36).

As reported in MTF and ESPAD, the lifetime history of inhalant use among middle adolescents in 1999 was 17% in the United States, and it ranged from 1% in Romania to 22% in Ireland. The corresponding estimate from the PACARDO project is 5%. Lifetime history of marijuana use was present for an estimated 41% in the United States, and it ranged from 2% in Romania and Cyprus to 37% and 41% in the Czech Republic and the United Kingdom, respectively. In the PACARDO survey, only about 5% of youths had tried marijuana. Extramedical tranquilizer use estimates in the PACARDO survey were similar to those found in the United States: the estimate from the PACARDO survey was 7%; the corresponding value from the MTF survey was 8%. In the ESPAD survey, lifetime history of extramedical tranquilizer use ranged from a low of 2%, in Estonia, to a high of 18%, in the Czech Republic and in Poland (37–39).

The data from this multicountry epidemiological surveillance project shed new light on adolescent drug experiences in all seven of the PACARDO countries, and in some of the partici-

pating countries this is the first published evidence on these topics. These findings may help motivate public health officials to give more attention to extramedical drug use in their planning and delivery of services for young people in these countries. With respect to alcohol and tobacco, substantial numbers of young people have started to use these drugs, and there is school-level clustering consistent with person-to-person spread and other processes that influence geographical concentrations of drug use. Although the use of inhalants and the illegal drugs is less prevalent in these seven countries, there is some evidence of school-level clustering, particularly with respect to marijuana and other illegal drugs. As such, there may be a reason to focus attention on prevention and early intervention strategies that discourage sharing and other modes of person-to-person spread of illegal drug involvement (28–30). In light of the relatively low estimates that we found for marijuana use and for other illegal drug use, the seven PACARDO nations are in a good position to implement prevention activities for youthful drug use, before the young people of these countries experience the escalated usage levels seen in Europe, the United States, and elsewhere in the world.

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RESUMEN

Proyecto de investigación PACARDO: el consumo de drogas entre la juventud en Centroamérica y la República Dominicana

Objetivo. Estimar el grado en que el consumo de drogas se produce y muestra una concentración en el nivel escolar entre adolescentes que asisten a la escuela en siete países de América Latina. Los datos presentados provienen del proyecto de investigación PACARDO, estudio epidemiológico conjunto multinacional.

Métodos. En el período de 1999–2000, se aplicaron cuestionarios anónimos autoadministrados sobre el consumo de drogas y conductas afines a una muestra transversal, representativa de la población nacional, que se compuso de un total de 12 797 estudiantes en los siguientes siete países: Costa Rica (n = 1 702), El Salvador (n = 1 628), Guatemala (n = 2 530), Honduras (n = 1 752), Nicaragua (n = 1 419), República Dominicana (n = 2 023) y Panamá (n = 1 743). (El nombre de PACARDO combina la PA de Panamá, la CA de Centroamérica y la RDO de República Dominicana). Se calcularon las oportunidades de exposición y el consumo de alcohol, tabaco, sustancias inhaladas, marijuana, cocaína (*crack*/pasta de cocaína), anfetaminas y metaanfetaminas, tranquilizantes, éxtasis y heroína sobre la base de las respuestas dadas a preguntas acerca de la edad en que se tuvo la oportunidad de probar cada una de las drogas, y en que se probó cada una de ellas, por primera vez. Para estimar las asociaciones de interés se aplicaron modelos de regresión logística con arreglo a la complejidad de la encuesta.

Resultados. Las siguientes fueron las frecuencias estimadas acumulativas del consumo de alcohol, tabaco, sustancias inhaladas, marijuana y drogas, respectivamente, en toda la muestra: 52%, 29%, 5%, 4% y 5%. Comparados con las mujeres, los varones fueron más propensos a consumir alcohol, tabaco, sustancias inhaladas, marijuana y drogas; las razones de posibilidades estimadas fueron, respectivamente, 1,3; 2,1; 1,6; 4,1 y 3,2. En todos los países se observó una concentración del consumo de alcohol y tabaco en el nivel escolar; el consumo ilegal de drogas también mostró una concentración escolar en Costa Rica, El Salvador, Guatemala y Panamá.

Conclusiones. Este informe arroja nueva luz sobre las experiencias de los adolescentes con la droga en Panamá, en los cinco países centroamericanos de tradición española, y en la República Dominicana. En él se presentan las primeras estimaciones del grado en que se concentra en las escuelas el consumo de drogas entre la juventud de estos siete países. Cuando se examinan a la luz de los resultados de encuestas escolares en América del Norte y en Europa, estas estimaciones apuntan a que el grado de consumo de drogas es más bajo en estos siete países americanos. Por ejemplo, en los Estados Unidos de América, 70% de los jóvenes encuestados habían consumido alcohol y 59% habían fumado tabaco. En cambio, en estos siete países, solamente 51% habían probado bebidas alcohólicas y solo 29% habían fumado tabaco. Futuras investigaciones ayudarán a explicar las variaciones observadas en los distintos países del mundo. En el entretiempo, el fortalecimiento de las iniciativas preventivas en las escuelas y otros ámbitos en el territorio de los siete países donde se lleva a cabo el proyecto PACARDO podría ayudar a estos países a frenar la diseminación del consumo de drogas entre la juventud, a reducir su concentración en las escuelas y a evitar las epidemias periódicas del consumo de drogas que se han producido en América del Norte.