Psychology of Violence

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Are Homicide and Drug Trafficking Linked to Peer Physical Victimization in Costa Rican Schools?

Gregorio Gimenez
University of Zaragoza

Liubov Tkacheva
Saint-Petersburg State University

Beatriz Barrado
University of Zaragoza

Objective: This study investigates the connection between crime rates and victimization by peer physical aggression in Costa Rican schools. Although previous research has demonstrated that peer victimization is related to community crime, no study to date has examined its association with homicides and drug trafficking, 2 criminal offenses that are key in Latin America. ***Method:*** We combined information on crime rates and socioeconomic characteristics at the district level with the data on peer physical victimization, school climate, and characteristics of student–teacher relationships, retrieved from the Programme for International Student Assessment Questionnaire. In total, 6,866 adolescents were surveyed, with an average age of 15 years, attending 205 schools, located in 154 districts. In the estimated probit model, the introduction of a variable representing districts' social development and of fixed effects, at school and district levels, helped us to deal with unobserved heterogeneity. ***Results:*** We found that attending schools situated in districts with higher homicide rates and cocaine confiscations increase the probability of suffering victimization by peer physical aggression at school, whereas attending schools with high economic, social, and cultural status, which offer sports activities for students and which were situated in the districts with a high level of social development, decrease the possibility of peer physical victimization. ***Conclusions:*** These results suggest that interventions beyond school level are needed to ensure the safety of students inside of schools and, thus, effective preventive programs should address crime at the neighborhood level.

Keywords: crime rates, victimization, drug trafficking, homicide, adolescents

Peer victimization is a huge social problem with wide prevalence all around the world (Lansford et al., 2012). Suffering peer physical victimization in adolescence can lead to dramatic prolonged consequences for the health and psychological well-being of the victims extending throughout their life span (Fang, Brown, Florence, & Mercy, 2012). Additionally, it puts them at increased risk for a number of adverse behavioral outcomes (Graham, Bellmore, & Mize, 2006) and immediate and long-term physical health problems (Hager & Leadbeater, 2016). Victims of peer victimization tend to experience depression, social exclusion, and low self-esteem (Crick, Ostrov, & Werner, 2006) and perform at poorer academic levels (Rigby, 2000). Victimization increases the risk for later impairment, mental instability, and criminal involvement (Turanovic, & Pratt, 2015). Knowing what factors play crucial roles in the manifestation and maintaining of peer victimization is necessary for timely intervention and providing effective prevention programs.

There are several risk factors for peer victimization in the context of community crime. Among them are adverse neighborhoods and school insecurity (Hidalgo-Rasmussen & Hidalgo-San Martín, 2015), violent localities and belonging to a gang (Jarillo, Magaloni, Franco, & Robles, 2016), social environments with high rates of assaults and drug abuse (Cabezas Pizarro & Monge Rodríguez, 2014), exposure to community violence (Schwartz & Proctor, 2000), and poverty and income inequality (Elgar et al., 2013). Peer victimization at school is a distinct form of peer behavior that is explicitly associated with concurrent social–psychological adjustment of adolescents (Crick & Dodge, 1994) and is generally believed to be based on social learning mechanisms (Bandura & Walters, 1977). Adolescents, through observa-

Gregorio Gimenez, Department of Applied Economics, Faculty of Economics and Business Administration, University of Zaragoza; Liubov Tkacheva, Department of Pedagogy and Pedagogical Psychology, Faculty of Psychology, Saint-Petersburg State University; Beatriz Barrado, Department of Applied Economics, Faculty of Economics and Business Administration, University of Zaragoza.

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Correspondence concerning this article should be addressed to Gregorio Gimenez, Department of Applied Economics, Facultad de Economía y Empresa, University of Zaragoza, Gran Vía, 2, C.P. 50005, Zaragoza, Spain. E-mail: gregim@unizar.es

tion and modeling in the community, learn and internalize social norms, expectations, and the roles that society represents them (Sampson, 1997).

The current study aims to investigate if there is a connection between crime rates at district level, measured as homicide rates and cocaine confiscations, and risk factors for peer physical victimization in schools. An important novelty is the combination of geolocalized data from Programme for International Student Assessment (PISA) for Costa Rica (OECD, 2017b) and highly disaggregated information on crime at the district level. Following ecological framework (Bronfenbrenner, 1994), we took into consideration different levels of macro and micro system, such as individual, social, educational, and economic contexts. According to this framework, we identified a set of additional factors that, together with crime rates, may play crucial role in occurrences of peer physical victimization, specifically socioeconomic development of the schools and districts, gender, lack of respect from teachers to students, disciplinary climate in the classroom, and extracurricular sport activities provided by schools.

Victimization by Peer Physical Aggression

Peer victimization is the experience of any act of aggression inflicted by similar-age peers (Graham et al., 2006). Physical victimization involves behavior that aims to cause physical pain like shoving, pushing, hitting, punching, or kicking, and also includes name-calling (Hong & Espelage, 2012). This form of victimization is widespread among urban youth (Swahn, Simon, Arias, & Bossarte, 2008) and often results in depression, loneliness, and externalizing problems (Crick et al., 2006). The victimization process can be triggered by both previous victimization experiences (Finkelhor, 2008) and a hostile high-risk environment (Cabezas Pizarro & Monge Rodríguez, 2014). For some adolescents, victimization is a short and transitory experience, whereas for others it is a recurring one (Cillessen & Lansu, 2015). Youths who suffered victimization are at high risk to be victimized again (Solberg & Olweus, 2003).

Community Crimes and Peer Victimization

The general tendency is that adolescents who live in cities are more prone to crime exposure than ones who live in nonurban environments (Schwartz & Proctor, 2000). Violence-related problems such as exposure to organized crime and drug-trafficking are more prevalent in poor areas (Jarillo et al., 2016). People living in violent environments face multiple stressors that contribute to their behavior. This implies a great social risk, which is revealed in mechanisms of social learning (Bandura & Walters, 1977). Exposure to crime has a significant impact on students' behavior at school increasing conduct problems and symptoms of anxiety (Chaux, Arboleda, & Rincón, 2012). Parental control mitigates the effects of community violence on peer victimization (Low & Espelage, 2014). Thus, living in proximity to crime areas and low parental control contribute to high risks for victimization. We must highlight that this empirical research could not escape a central methodological difficulty: unobserved heterogeneity. "Communities more likely to be exposed to homicides and other types of violence differ from nonviolent neighborhoods on factors that may also affect educational outcomes" (Caudillo & Torche, 2014, pp. 89–90).

Social Development of the Districts, Extracurricular Activities, and Peer Victimization

A growing body of theory and evidence has implicated the role of adverse neighborhoods and poor socioeconomic conditions in peer victimization (Engström, 2018; Sampson, 2011), considering that districts with high levels of chaos and insecurity usually present higher rates of crime (Sampson, 1997). These conditions increase criminal behaviors and influence the development of self-control, affecting individual risks for victimization (Holt, Turner, & Lyn Exum, 2014). Low social support aggravates the problem of peer victimization at school (Rigby, 2000). The youth whose leisure time is unstructured and unsupervised are at higher risk for victimization (Lee, Lewis, Kataoka, Schenke, & Vandell, 2018). The connection between extracurricular sport activities and peer victimization has been investigated in many studies. The results seemed somewhat contradictory and depended mostly on specific conditions such as the number of sports activities, whether they were provided on a school basis or on a multischool basis, and security measures (Peguero, 2008). Thus, the positive effect of extracurricular activities on reducing peer victimization depends mostly on microlevel contextual factors such as social contexts of districts, type of school, and rigidity of social control (Guest & McRee, 2009).

School Climate and Peer Victimization

Adolescents spend a lot of time at school, and school climate affects their emotional and social development and is an important factor in maintaining social trust between young people and adults (Morrill & Musheno, 2018). School climate is closely related to peer victimization (Hong & Espelage, 2012; Wang, Berry, & Swearer, 2013), which generally occurs in schools where the level of supervision is low (Rigby, 2000) and where students have negative relationships with teachers (Longobardi, Iotti, Jungert, & Settanni, 2018; Wang, Swearer, Lembeck, Collins, & Berry, 2015). The higher the rates of student–student and teacher–student conflict at school, the greater the probability of oppositional, attentional, and conduct problems (Bauman & Del Rio, 2006). Students who experience positive attitudes toward classmates and teachers have less risks to be victimized (Kasen, Berenson, Cohen, & Johnson, 2004). Thus, respectfulness and social trust are protective factors against peer victimization, as well as strict requirements to school discipline (Cornell, Shukla, & Konold, 2015).

The Case of Costa Rica

The present analysis was carried out in Costa Rica, a country located in Central America, a region where violence is a serious issue. Although its levels of violence are far from those of other Central American countries, such as Honduras, Guatemala or El Salvador, in recent years, Costa Rica has experienced an alarming increase in its crime rates. According to Unidad de Información y Estadística Nacional sobre Drogas (2018), the amount of cocaine confiscated went from 9,959 kilos in 2010 to 27,838 kilos in 2017. Simultaneously, the country has experienced a huge increase in violent crimes. The rate of intentional homicides in Costa Rica in 2017 (11.9 per 100 000 inhabitants) doubled both the world average and the rate presented by the country a decade earlier

(United Nations Office on Drugs & Crime, 2018). The group of youths aged between 15 and 29 years has one of the highest rates of intentional homicides (20.3 victims per 100,000 inhabitants). Almost one third of these deaths was related to drug trafficking (Comisión Técnica Interinstitucional sobre Estadísticas de Convivencia y Seguridad Ciudadana, 2017). Costa Rica is one of the countries in Central America providing the most accurate statistics, both with regard to the variety of the collected information and to the methodological quality of its elaboration. This makes Costa Rica a highly suitable case for analysis.

The Current Study

Although previous research has found that peer victimization is related to community crime, as far as we know, no study to date has specifically examined its association with homicides and drug trafficking. We suppose that higher crime rates are linked to victimization, especially to peer physical victimization, which is widely prevalent (Swahn et al., 2008). Following ecological framework (Bronfenbrenner, 1994) and focusing on individual, educational, social, and economic levels, we formulated the following hypotheses.

Hypothesis 1: Our main hypothesis is that students attending schools situated in districts with higher crime rates (measured as homicide rates and cocaine confiscations) will have higher possibilities of being victims of peer physical aggression inside school.

Hypothesis 2: Additional hypotheses are that peer physical victimization inside school will be (a) positively related to being male, lack of respect from teachers to students, and poor disciplinary climate in the classrooms; and (b) negatively related to teacher support in the classroom, extracurricular sport activities provided by school, and high social development in the districts where the school is situated.

Method

Participants and Procedure

Our research relied on the 2015 questionnaire from PISA. This international program, created by the Organisation for Economic Cooperation and Development (OECD, 2016), tests the skills and knowledge of 15-year-old students in reading, mathematics and science. Seventy-two countries took part in the 2015 assessment. In Costa Rica, participants included 6,866 students (3,494 girls and 3,372 boys) from 205 schools distributed in 154 districts. As such, the data presented a nested structure with three levels. The sample was representative of the target population: 15-year-old students throughout all the country attending educational institutions in Grades 7 and higher. OECD (2017a, Chapter 4) explains the sampling principles applied in PISA to ensure representation of the full target population.

In addition to the cognitive test, students answered a background questionnaire. The questionnaire sought information about the students, their homes, their school and learning experiences. School principals completed another questionnaire, which covered the school system and the learning environment. These questionnaires contained key information concerning victimization by peer aggression, and its student-and-school-level predictors, that we used in our study. In a further step, we matched the PISA data set with highly disaggregated information on crime rates and socioeconomic characteristics of the districts where the schools were situated, kindly provided by the Ministerio de Educación and Programa Estado de la Educación. To do so, we obtained the geolocation of the schools participating in PISA. As we had the information of the location of every school, of crime rates and socioeconomic characteristics in every district, no observations were lost in the matching process of the PISA and crime data sets.

This multidimensional data set allows us to benefit from a methodological approach that helps to deal with unobserved heterogeneity, using fixed effects. To the best of our knowledge, no effort to combine criminal geolocalized data and the PISA survey has previously been made to understand the impact of crime rates on peer physical victimization. Additionally, we employed two measures of crime rates: homicide rate and confiscations of cocaine. The latter is unusual in the literature in the field.

It is our understanding that our research was conducted in accordance with ethics requirements of our universities and is exempt from research ethics committee oversight. The reason is that PISA data set is a source of public access in which subjects cannot be identified or exposed to risks, liabilities, or reputational damage. In addition, crime data came from official public sources and were handled in all our research in an aggregated manner, as districts' averages. Overall, in the data set we have managed in the study, human subjects could not be identified in anyway.

Measures

Reliability. Specific standards (such as national review, cognitive labs, centralized transfer of trend material, and monitoring and recording of procedures) underlie the PISA questionnaire and the implementation of the material into the final instruments (OECD, 2017a, p. 62). The questions were developed specifically for PISA by a Questionnaire Expert Group. Kuger, Klieme, Jude, and Kaplan (2016) have provided detailed information about analytical framework, design, and psychometric properties of the questionnaires.

The data set includes composite indicators and single-item measures (SIM) than can be used to measure specific issues. In our empirical work, schools' socioeconomic status was measured through a composite score, and victimization by peer physical aggression, disciplinary climate, teacher support, and lack of respect from teachers to students were measured using SIM. To ensure the psychometric properties of the variables, the PISA work team performed analyses separately for each country to evaluate the validity of these single items; irregular cases, such as outliers as well as cases with obvious scoring rule deviations, were identified and treated (OECD, 2017a, p.134).

Despite these statistical checks, the use of SIM from PISA can constitute a limitation in our research. SIM variables may be more vulnerable to random measurement errors, and their internal consistency reliability statistic cannot be computed. However, SIM also have psychometric advantages and, if the meaning of the construct is sufficiently narrow and clear to the respondent, they can be as effective as multiple-item scales in self-report questionnaires (Hoeppner, Kelly, Urbanoski, & Slaymaker, 2011; Postmes, Haslam, & Jans, 2013). SIM eliminate item redundancy and there-

fore reduce the fatigue and boredom associated with answering highly similar questions repeatedly. Asking more or less the same question many times may, in fact, compound systematic errors, and there are good reasons to believe that measurement errors could not be randomly distributed across items in multiple-item responses (Robins, Hendin, & Trzesniewski, 2001). Rather, SIM reduce the chance of common method variance where spurious correlations are observed due to the use of the same response format among highly related items (Williams, Cote, & Buckley, 1989). SIM can provide an acceptable balance between practical needs and psychometric concerns, and the empirical literature contains many examples where they *have shown comparable or equal predictive validity compared with multiple-item measures* (Hoeppner et al., 2011). Issues focused on subjective well-being (Sandvik, Diener, & Seidlitz, 2009), life satisfaction (Nagy, 2002), self-esteem (Robins et al., 2001), bullying (Solberg & Olweus, 2003), or interparental violence (Reuter, Sharp, Temple, & Babcock, 2015) have been assessed successfully using SIM.

Next, we describe the variables and sources used in the empirical study. The PISA data set was the source from which we took the dependent variable and the predictors at student and school level. Except for the case of peer victimization, which we explain later, we processed every SIM maintaining the original response options that are in the PISA questionnaire. In the case of the socioeconomic and crime predictors at district level, we used continuous variables retrieved from official Costa Rican sources.

Dependent variable. OECD (2017a) includes include a set of questions about bullying. Students answered how often ("never or almost never," "a few times a year," "a few times a month," "once a week or more") during the 12 months before the PISA test they had had the following experiences in school: "Other students left me out of things on purpose" (relational bullying); "Other students made fun of me" (verbal bullying); "I was threatened by other students" (verbal/physical bullying); "Other students took away or destroyed things that belonged to me" (physical bullying); "I got hit or pushed around by other students" (physical bullying); and "Other students spread nasty rumors about me" (relational bullying). Exploratory analysis of the data, carried out by the PISA work team, showed that the first two of the eight items on bullying presented measurement issues, were not strongly correlated with the other six items and did not load well onto a unidimensional construct. Thus, the PISA, 2015, international database just offers information about the SIM of the questionnaire on bullying and not a composite scale (OECD, 2017b, pp. 252, 299).

Our endogenous variable relied on the question "During the past 12 months, how often have you had the following experience in school? I got hit or pushed around by other students" (PISA code ST038Q07NA). Students might find it relatively difficult to distinguish between "a few times a month" and "once a week or more" and the variation between the two categories might reflect different interpretations of the question. So, we built a dummy variable = 0 if the student responded "never or almost never," and = 1 in the rest of the cases (8.10% of the students, 6% of the girls and 11.9% of the boys). It should be highlighted, that this single item cannot capture, by itself, bullying but rather represents victimization by peer physical aggression.

Predictors.

Student-level factors. At this level, we considered the gender, lack of respect from teachers to students, the disciplinary climate, and the teacher support. The gender was given by the variable with the PISA code ST004D01T (50.89% of the sample were girls and 49.11, boys). Lack of respect from teachers to students was measured with the variable "During the past 12 months, how often did you have the following experience at school? Teachers said something insulting to me in front of others" (PISA code ST039Q06NA). The four questionnaire responses were "never or almost never" (91.32% of the students), "a few times a year" (5.46%), "a few times a month" (1.74%), and "once a week or more" (1.48%). Disciplinary climate was measured through the question "How often do these things happen in your school science lessons? Students do not listen to what the teacher says" (PISA code ST097Q01TA). The four response options were "never or hardly ever" (7.86% of the students studied in schools whose principal chose this option), "every lesson" (17.91%), "most lessons" (52.38%), and "some lessons" (21.85%). Teacher support in the classroom was measured with the question "How often do these things happen in your school science lessons? The teacher gives extra help when students need it" (PISA code ST100Q02TA). The four response options were "never or hardly ever" (52.16% of the students studied in schools whose principal chose this option), "every lesson" (28.49%), "most lessons" (14.8%), and "some lessons" (4.55%).

School-level factors. Sport activities at school were measured with the question "School offers sporting team or sporting activities" (located within the group of variables that measured extracurricular activities and with the PISA code SC053Q10TA). The responses were "no" (6.11 of the students studied in these schools) and "yes" (93.89%).

Finally, the economic, social and cultural status (ESCS) of every school was calculated as the school average of the PISA composite score (code ESCS). This index is built by the PISA project work group, via principal component analysis, using the indicators parental education (PARED), highest parental occupation (HISEI), and home possessions (HOMEPOS).[1] ESCS was defined as the component

[1] Occupational data for both the student's father and student's mother were obtained from responses to open-ended questions. The responses were coded to four-digit International Standard Classification of Occupations codes and then mapped to the international socioeconomic index of occupational status (ISEI). The highest occupational status of parents (HISEI) corresponds to the higher ISEI score of either parent or to the only available parent's ISEI score. For all three indices, higher ISEI scores indicate higher levels of occupational status. Indices on parental education were constructed by recoding educational qualifications into the following categories: (0) None, (1) International Standard Classification of Education (ISCED) 1 (primary education), (2) ISCED 2 (lower secondary), (3) ISCED Level 3B or 3C (vocational/prevocational upper secondary), (4) ISCED 3A (general upper secondary) and/or ISCED 4 (nontertiary postsecondary), (5) ISCED 5B (vocational tertiary), and (6) ISCED 5A and/or ISCED 6 (theoretically oriented tertiary and postgraduate). The index of highest educational level of parents corresponds to the higher ISCED level of either parent. The index of highest educational level of parents was recoded into estimated number of years of schooling (PARED). HOMEPOS was constructed as a summary index of all household and possession items (included in questions ST011, ST012, and ST013 of the questionnaire). For students with missing data on one out of the three components, the missing variable was imputed. Regression on the other two variables was used to predict the third (missing) variable, and a random component was added to the predicted value. If there were missing data on more than one component, ESCS was not computed and a missing value was assigned for ESCS. After imputation, all three components were standardized for OECD countries and partner countries/economies with an OECD mean of zero and an *SD* of 1 (OECD, 2017b, p. 339).

score for the first principal component. The higher the score, the higher economic, social and cultural status. For Costa Rica, the scale reliabilities (Cronbach's α) for the *z*-standardized variables was 0.73. The average value of the ESCS for all schools was −0.79.

District-level factors. The social development in the districts where the schools were situated was measured through a composite indicator. This is the Social Development Index (SDI) designed by the Statistical Division of the Ministerio de Planificación Nacional y Política Económica (MIDEPLAN) of Costa Rica. It was constructed by applying principal component analysis to a set of standardized socioeconomic indicators grouped in four dimensions.[2] These are (a) economy: a decent standard of living through earning income from participating in an economic activity; (b) education: adequate access to educational and training services that contribute to the development of human capital; (c) health: possibility of enjoying a healthy life, which implies having access to formal health care, guaranteeing an adequate quality of life; and (d) electoral participation: development of the sense of belonging and social cohesion among the population, reflected through the participation in national and local civic procedures (MIDEPLAN, 2013, pp. 15–16). The SDI is built every four years and was referred in our study to the year 2013, the closest year to 2015, when the rest of the variables were measured. It showed values between 0 and 100. The higher the value of the index, the higher the level of development. The average score was 65.45. The internal and external statistical validity of the SDI was verified by means of correlation and regression techniques between the index and the variables used in its elaboration. The results are available in Tables 3 to 6 of the SDI technical report (MIDEPLAN, 2013, pp. 26–28).

To measure crime rates in 2015, we relied on two key aspects: homicide rates and cocaine confiscations. The data on homicide rates in 2015 were provided by the Oficina de Planificación y Estadística del Poder Judicial of the Ministerio de Justicia y Paz of Costa Rica and corresponded to formal complaints to the Organismo de Investigación Judicial.[3] The average homicide rate in our sample was 11.35 homicides per 100,000 inhabitants. The data on cocaine confiscations in 2015 came from the Unidad de Información y Estadística Nacional sobre Drogas of the Instituto Costarricense Sobre Drogas, ascribed to the Ministerio de la Presidencia. Drug trafficking was estimated through confiscations of cocaine in kilos per 100,000 inhabitants. This estimation allowed us to correct the effect of the districts for the scale. The cumulative distribution of the confiscations followed an exponential function that was a consequence of the huge differences in the amount of confiscations, from just a few grams to several tons.[4] The extreme variability in the amounts confiscated made it convenient for our analysis to take logarithms in the variable. The average confiscation in our sample was 351 kilos per 100,000 inhabitants (5.86 in logarithm). Extreme values, of both homicide rates and cocaine confiscations, could affect the estimation and lead to obtaining biased results. For this reason, we performed an analysis through box plots that let us detect their presence. The three districts with crime rates above the upper whisker and the three districts below the lower whisker were not included in analysis. There were no outlier problems concerning the rest of the variables in the study.

After the elimination of outliers, and considering the presence of missing data (which represented 34% of the sample), the final sample consisted of 4,243 observations (62% of the observations of the original database). We performed a statistical sensitivity power analysis to determine the smallest effects related to our objectives that we would have adequate power to detect. With an $\alpha = .05$ and power = 0.95, the minimum effect size (ES) that is likely to be detected with this sample is ES = .003.Thus, this sample size was more than adequate for the statistical analysis carried out in the research.

Analytic Plan

We used a discrete probit model for binary response to determine the link between crime rates and peer physical victimization in schools.[5] In equation (1), the probability of being a victim of peer aggression depends on a set of psychological and socioeconomic factors, including crime rates in the districts where the schools are situated, as regressors:

$$P(victimization_{ijk} = 1 \mid x) = \beta_0 + \beta_1 X_{ijk} + \beta_2 Z_{jk} + \beta_3 D_k + school_{FE} + district_{FE} + \varepsilon_i \quad (1)$$

In this model, $P(victimization_{ijk} = 1|x)$ represents student *i*-th, attending school *j*-th, situated in district *k*-th, probability of having been hit or pushed by other students. This probability was determined by a set of factors at student level (X_{ijk}), school level (Z_{jk}), and district level (D_k). Student level included gender, lack of respect from teachers to students (variable *Teachers said something insulting to me in front of others*), disciplinary climate (variable *Students do not listen to what the teacher says*), and teacher support (variable *The teacher gives extra help when students need it*). School level included whether the school offers *sporting team or sporting activities* and *socioeconomic characteristics of the schools*. District-level included a

[2] The index is the only tool that measures social development from the district level and it is used by the Costa Rican government for the definition, monitoring, and evaluation of public policies and projects, as well as for the diagnosis of the social situation of the districts and regions of Costa Rica (MIDEPLAN, 2013, p. 5).

[3] The number of homicides per 100,000 inhabitants that represents the homicide rate is widely used in empirical studies. Different bodies of law have a more homogeneous definition of homicide than of other criminal offenses; thus, the data were more easily comparable. In addition, its measurement was more accurate, because other offenses, especially misdemeanors, are often not reported to the police for various reasons, such as the costs and hassles inherent in the presentation of complaints and a lack of trust in the local police force and/or the judicial system (Gimenez, Svitková, Tkacheva, & Barrado, in press).

[4] According to the Unidad de Información y Estadística Nacional sobre Drogas of the Instituto Costarricense sobre Drogas (2018), 94.87 percent of drug confiscation events were in quantities of 0 to 5 grams. Only 1.53 percent of the confiscations corresponded to stashes of more than 100 grams. The confiscations were concentrated in the most economically and socially vulnerable areas and in zones with serious deficiencies in personal rights, security, housing, labor opportunities, nutrition, infrastructures, and basic medical assistance.

[5] These models relate the probability of an event to various independent variables and are based on the cumulative normal probability distribution. The relationship between a specific regressor and the outcome of the probability is interpreted by means of a marginal effect, which accounts for the partial change in the probability. Once the model is estimated, marginal effects are calculated for each variable while holding other variables constant at their sample mean values. In the case of factor levels, the marginal effect is the discrete change from the base level.

variable to measure the *social development* of the districts and our key variables *homicide rate* and *cocaine confiscations*. Crime rates may be correlated with latent factors and, if we do not correct for them, the coefficients of the variables *homicide rate* and *cocaine confiscations* could be reflecting the effects of these factors and, thereby, be biased. For example, poverty, inequality, and lack of education are elements strongly associated with crime (Gimenez, Svitková, Tkacheva, & Barrado, in press). To avoid biased estimations, the model included the SDI, a variable explained in the previous section, that accounted for a wide set of socioeconomic factors in the districts, generally believed to be correlated with severe crimes. Additionally, the model incorporated fixed effects that allowed to control for characteristics of each school and district that, without being explicitly recognized in the model, were related to peer physical victimization. ε_i is the error term. Estimations were executed with Stata 16 statistical software.

Results

Table 1 presents results estimated from the binary probit model. For the outcome variable, the value 0 denoted that the student was not being hit or pushed around by other students, and 1 that he or she was. McKelvey and Zavoina's pseudo-R^2 was calculated (0.643). This value indicated that the independent variables included in the probit model explained a high level of the probabilities of peer physical victimization.

The estimated coefficients and standard errors strongly supported our main hypothesis: Studying in schools situated in districts with higher homicide rates and cocaine confiscations increased the probability of peer physical victimization in school. Further, in line to our secondary hypotheses, we found that (a) being male, lack of respect from teachers to students (variable *Teachers said something insulting to me in front of others*), and poor disciplinary climate (variable *Students do not listen to what*

Table 1
Estimates of the Binary Probit Model

Variable	Coefficient	Robust *SE*	*z* statistic	$p > z$	Marginal effects
Intercept	−10.827***	0.531	−20.410	<.01	0.096
Baseline variables					
Student					
Gender					
Female	Base				
Male	0.375***	0.075	5.030	<.01	0.056
During the past 12 months, how often did you have the following experience at school?					
Teachers said something insulting to me in front of others					
Never or almost never	Base				
A few times a year	0.943***	0.132	7.150	<.01	0.214
A few times a month	0.008	0.274	0.030	0.98	0.001
Once a week or more	1.119***	0.177	6.320	<.01	0.272
How often do these things happen in your school science lessons? Students do not listen to what the teacher says					
Never or hardly ever	Base				
Every lesson	0.241**	0.142	1.690	0.09	0.035
Most lessons	0.364***	0.106	3.440	<.01	0.057
Some lessons	0.102	0.088	1.160	0.25	0.014
How often do these things happen in your school science lessons? The teacher gives extra help when students need it					
Never or hardly ever	Base				
Every lesson	−0.189	0.154	−1.230	0.22	−0.029
Most lessons	−0.101	0.157	−0.640	0.52	−0.016
Some lessons	−0.019	0.155	−0.120	0.90	−0.003
School					
School offers sporting team or sporting activities					
No	Base				
Yes	3.487***	0.210	16.600	<.01	0.154
Economic, social, and cultural status	−0.215**	0.089	−2.400	0.02	−0.032
District					
Social development index	0.025***	0.003	9.200	<.01	0.004
Exposure to crime					
Homicide rate	0.116***	0.009	12.520	<.01	0.017
Cocaine confiscations rate (in logs)	0.698***	0.052	13.500	<.01	0.104
Number of observations	4,243				
McKelvey and Zavoina's pseudo R^2	0.643				
Log pseudolikelihood	−8,823.003				

Note. The dependent variable is "During the past 12 months, how often have you had the following experience in school? I got hit or pushed around by other students." Regressions are weighted by students' sampling probability. Robust standard errors adjusted for clustering at the district level. Fixed effects in school and districts are used.
(***) and (**) denote significance at the 1% and 5% levels, respectively.

the teacher says) increased the possibility of suffering peer physical victimization; (b) studying in schools that offered sporting activities, that had a higher average economic, social, and cultural status, and that were located in districts with a higher level of social development decreased the possibility of victimization; and (c) the three categories for teacher support (*The teacher gives extra help when students need it*) were not statistically significant.[6]

The last column of Table 1 shows the marginal effects on the probability of being a victim of physical aggression. Focusing on our central variables, on average, an increase in a marginal unit in the homicide rate and cocaine confiscations increased the probability of victimization by peer aggression by 1.7% and by 10.4%, respectively.

Graphing these predicted probabilities helped us to understand the nexus between crime rates and victimization. In Figure 1, we represent the predicted probabilities of being a victim of physical aggression in school for all the homicide rates of the districts in the sample. These average predicted probabilities were calculated using the average sample values of the other predictor variables. The figure shows that the higher the homicide rate, the higher the probability of being victimized. For example, the mean predicted probability of being a victim of physical aggression was only 0.55% in districts with no homicides (where 34% of the students studied). This probability increased to greater than 50% for students who attended schools situated in districts with homicide rates higher than 22 homicides per every 100,000 inhabitants (where 8.62% of the students studied).

With respect to cocaine confiscations, Figure 2 shows a direct relationship between cocaine confiscations and the probability of being a victim of physical aggression. If the students attended schools situated in districts where confiscations were less than 400 kilos of cocaine for every 100,000 inhabitants (6 in logarithm), the mean predicted probability of victimization was low (less than 20%). In the sample, 60% of the students went to schools situated in these districts. In districts with confiscations higher than 3,000 kilos (8 in logarithm), where 12.3% of the students studied, the probability of aggression increased by more than 50%.

Missing data were list-wise deleted when running the analyses. To examine whether they were missing as a function of any variables in the study and could bias significantly our results, we tested differences between participants with complete and incomplete data. Chi-square analyses showed, at 5% level of significance, that participants with incomplete data did not differ significantly from those with complete data on the variables that presented missing values: "Teachers said something insulting to me in front of others" (918 missing values, $\chi^2 = 3.752$, $p = .053$); "Students do not listen to what the teacher says" (555 missing values, $\chi^2 = 2.750$, $p = .097$); "The teacher gives extra help when students need it" (669 missing values, $\chi^2 = 2.306$, $p = .129$); "School offers sporting team or sporting activities" (102 missing values, $\chi^2 = 3.349$, $p = .067$). The rest of the variables, "Gender," "Economic, social and cultural status," "Social Development Index," "Homicide rate," and "Cocaine confiscations rate" did not present missing data. The missing values were homogeneously distributed among schools and districts, following a normal distribution. The percentage of missing cases among schools followed a normal distribution of $M = 5.071$ and standard deviation = 3.717, with a Jarque-Bera normality test value = 1,800.03, $p < .001$. In the case of the distribution among districts, they followed a normal distribution of $M = 5.227$ and standard deviation = 3.221, with a Jarque-Bera normality test value = 107.081, $p < .001$. Based on this analysis, we treated the missing cases as though they were missing at random, because there was no reason to believe that they were missing as a function of any variables in the study.

To summarize, the results provide strong evidence in support of the connection between crime rates in the districts where schools are situated, measured as rates of homicides and drug trafficking,

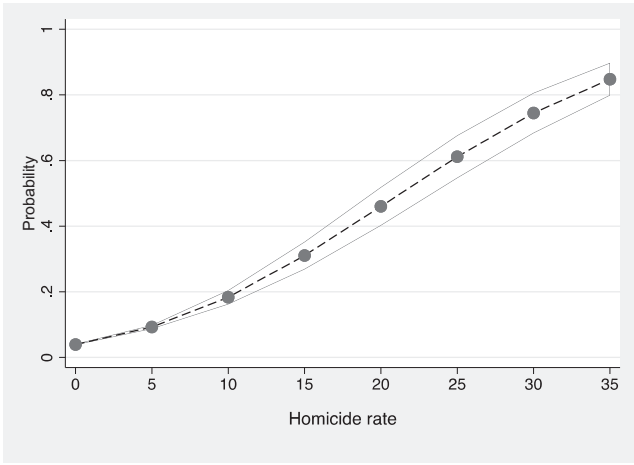

Figure 1. Homicide rate and predictive margins for the probability of being hit or pushed around by other students (95% confidence intervals).

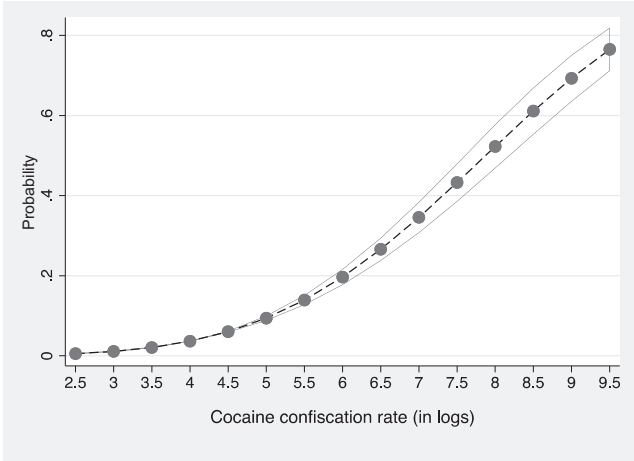

Figure 2. Cocaine confiscation rate and predictive margins for the probability of being hit or pushed around by other students (95% confidence intervals).

[6] To test an overall effect of the variables with more than one category, we performed a χ^2 test of whether all predictors' regression coefficients of the categories in the variable were simultaneously zero. The overall effects of the three categories in the variable *Teachers said something insulting to me in front of others* and *Students do not listen to what the teacher says* were statistically significant at any standard level χ^2_3=87.23 and χ^2_3= 13.78, respectively). The overall effect of the variable *The teacher gives extra help when students need it* was not (χ^2_3= 4.37).

and the probability of being a victim of peer physical aggression inside schools. The results also demonstrate how adverse neighborhood and low socio-economic status of the school's district exacerbate the situation of peer physical victimization.

Discussion

Using a large sample of 15-year-old Costa Rican students, the novel findings of this study revealed that attending schools that were situated in districts with higher homicide rates and cocaine confiscations increased the probability of being a victim of peer physical aggression at school. These results are consistent with previous literature that has noted the relationship between homicide rate and academic achievement (Gimenez & Barrado, 2020; Jarillo et al., 2016), and between exposure to community violence, through witnessing and through direct victimization, and peer group social maladjustment, in the form of aggression, peer rejection, and bullying by peers (Schwartz & Proctor, 2000). Though we could not conclude that peer physical victimization was caused by crime exposure or previous psycho-traumatic experiences due to known limitations of our study, these findings still confirmed the fact that there is a connection between crime rates at district level and peer physical victimization at school. Possible explanations for our findings laid in the fields of ecological framework, asserting influence of different level factors on adopting behavioral models (Bronfenbrenner, 1994; Hong & Espelage, 2012) and social learning theory, which declares that observation through modeling is the way young people learn new behavior (Bandura & Walters, 1977). Thus, our findings supported the idea that adverse neighborhoods and poor socioeconomic conditions play crucial roles in peer victimization, which corresponds with previous research (Engström, 2018; Sampson, 2011), confirming that studying in schools that have higher average economic, social, and cultural status and that are in districts with a higher level of social development decrease the possibility of being a victim of peer physical aggression.

Our findings also showed that being a male and studying in an unfriendly educational environment, where there is a lack of respect from teachers to students (variable *Teachers said something insulting to me in front of others*), increased the possibility of peer physical victimization. The finding that being a male was associated with higher risks of peer physical victimization is consistent with results of previous research, showing that boys are more likely to be physically victimized by peers than girls (Lansford et al., 2012). It is well known that support from teachers at school is strongly associated with students' psychological well-being (Chu, Saucier, & Hafner, 2010). Thus, the finding that lack of respect from teachers to students affected peer victimization was not surprising. The body of research in the field suggests that students who have negative relationships with teachers are more likely to be rejected by peers (Longobardi et al., 2018) and victimized (Wang et al., 2015). However, we found that the three categories for teacher support were not statistically significant. A possible reason is the narrowness of this variable, as it only measured teacher support during science classes (main subject in 2015 PISA round) but did not capture general support. Also, although some studies have shown that teacher support helps to decrease peer victimization, others report little or nonsignificant effects, and the results often depend on methodological choices (Troop-Gordon, 2015). Furthermore, our findings suggested that studying in an educational environment with discipline problems (variable *Students do not listen to what the teacher says*) increased the probability of being a victim of peer physical aggression. As previous literature has noted, school climate and discipline problems are associated with peer victimization (Cornell et al., 2015; Hong & Espelage, 2012; Wang et al., 2013). It seems that both variables in connection to student–teacher relationships, lack of respect from teachers to students and disciplinary climate, illustrate the lack of respectfulness and social trust, which is supposed to be shared feelings and normally demand mutual desire of the involved parties to be properly established. Though, the question whether teachers or students first showed disrespect goes beyond our study.

Finally, our results showed that studying in schools that offered sporting activities, had higher average economic, social, and cultural status and were in districts with a higher level of social development decreased the possibility of suffering peer physical victimization. Generally, it is believed that providing students with extra activities at school helps to create peer connectedness and facilitates prosocial behaviors (Lee et al., 2018). On the other hand, results of many studies have shown that positive influence of extracurricular sport activities on reducing peer victimization depends mostly on specific social contexts (Guest & McRee, 2009; Peguero, 2008). Thus, we had to associate this finding to the high social, cultural, and economic status of schools and districts rather than the sports activities themselves, because the higher the social development of the districts, the more facilities and resources are available to provide students in their leisure time.

The current study has several methodological advantages worth noting. Previous studies examining associations among community crimes and peer victimization have largely focused on exposure to community crimes but did not use models that controlled for districts' socioeconomic characteristics. Furthermore, this study appears to be the first to use a methodological approach that helped us to deal with unobserved heterogeneity.

Limitations

Our study is limited by the fact that the PISA sample is representative of just 15-year-old students, which restricts the conclusions. Further research is needed to test the effects in the case of students of different ages. We also recognize that the use of PISA background questionnaires exhibits several problems, as Rutkowski and Rutkowski (2010) have pointed out. One is the presence of missing data that is especially important in some economically developing economies. The other, the possible respondent misinterpretation of the questions and/or answers, due to its poor design. This problem can be aggravated by the lack of motivation for the students to answer questionnaires without consequences in their school records.

Furthermore, the use of SIM is a significant limitation of the study. Even though its use has certain psychometric advantages, which we have pointed out in the methodological section, there are a number of psychometric reasons to be skeptical about the use of SIM when compared with multiple-item scales: (a) They are more vulnerable to unknown biases in meaning and interpretation; (b) their internal consistency reliability statistic cannot be computed; and (c) they can be more affected by random measurement errors,

which are more likely to be cancelled out with multiple items (Hoeppner et al., 2011; Robins et al., 2001).

Literature has pointed out that violence close to the school has a decisive influence on students, as students spend a significant part of their time in their schools and carry out numerous extracurricular and leisure activities in the area around the school (Gimenez, Martín-Oro, & Sanaú, 2018). Still, another limitation is that data on crime rates refer to the districts where the schools are located. In Costa Rica, they correspond to the districts where the students live in the vast majority of cases, but not in all.

Finally, the use of a cross-sectional survey presents limitations in terms of the study of causality. Hence, a promising extension for future research would be to use a longitudinal perspective. As, in Costa Rica, some of the schools participating in PISA do so in different rounds of the survey, this information would allow us to jointly control for time and cross-sectional perspectives that would mitigate the endogeneity issue.

Research Implications

In sum, our findings support previous research that highlights the link between community crimes, social development of districts and schools, and peer victimization (Chaux et al., 2012; Engström, 2018). In line with the social learning theory, peer physical victimization is more likely to happen in criminogenic environments as the result of learning through modeling. Appealing to ecological framework, we can explain how economic, social, and educational contextual factors influence peer physical victimization. We conclude that crime rates near the schools, measured by the homicide rate and cocaine confiscations, are significantly related to the probability of peer physical victimization inside the schools, which is also associated with being a male and having a poor disciplinary climate at school. Future research should address broader sets of factors to capture the complex interactions between crime rates and social, economic, educational, and family contexts on peer physical victimization.

Prevention and Policy Implications

Aiming to prevent peer physical victimization in school, social, economic, and educational factors should be targeted to reduce the effect of community crimes on peer victimization. During recent years, policy efforts to reduce peer victimization at schools have been based on individual, family and school factors, including broader social contexts such as community and societal levels (Espelage & Swearer, 2010). This study suggests that policymakers should also take into consideration the impact of crime rates on peer victimization. Our results make clear that not only school context plays an important role in the development of peer physical victimization, but also district and neighborhood levels. Thus, beyond school-level interventions are needed to ensure the safety of students inside schools. Effective prevention programs need to address violence at the neighborhood level. Authorities in Costa Rica clearly advocate for this approach, strengthening local governance structures, preventing gang violence, increasing the number of security forces in key places where illicit activities and gang presence concentrate and controlling light arms and firearms (Ministerio de Justicia y Paz, 2011). Future research may consider evaluating programs focused on reducing crime rates surrounding schools and social support to improve student–teacher relations.

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