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Micro-level Factors Associated with Youth Drug Use Among an Urban at-Risk Youth Sample

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Abstract

Background Youth drug use has reached global epidemic proportions with unequal distribution among communities with low income, immigrants, or ethnic status.

Purpose This study seeks to understand the association between micro-level factors and youth drug use behavior among 2693 low-income, ethnic, and immigrant youths in Pomona, CA, USA. The study uneath's unique evidence and intervention elements necessary to resolve youth drug use in Pomona.

Methods We used social cognitive theory as a conceptual framework, and performed correlation and multiple linear regression analysis in a cross-sectional design.

Results and Discussion The results reveal that attitudes, perceptions, and behavior related to friends, participants, family, and adults in the participant's life and ease of access to drugs are associated with youth drug use. Variables related to friends and participants show a relatively stronger association with youth drug use in comparison to variables related to parents and adults in participants' lives. Equally, drug and non-drug antisocial behavior of friends and participants show a stronger association with youth drug use relative to prosocial behavior. Also, when a diverse set of predictor variables are combined together, their association to the outcome variable is stronger than that of a single variable.

Recommendations Future interventions in Pomona should prioritize strategies which target participants and friends over activities targeting parents and adults. Interventions targeting antisocial behavior should be prioritized over prosocial behavior. Program implementers should also develop unique evidence and tools which will help parents influence the drug use behavior of youths in Pomona and similar communities.

Keywords Influence of friends in youth drug use · Micro-environmental factors in youth drug use · Adult and parental influence in youth drug use · Ease of access and youth drug use · Youth drug use in at-risk communities

Introduction

Youth drug use has reached "global epidemic proportions [1–3], with unequal distribution among communities with low socio-economic status [2]. Adolescent drug use tracks into adulthood [4], and is associated with short-and long-term disease burdens and harms including the following: changes in appetite; premature death; wakefulness; heart rate and blood pressure; heart or lung disease; cancer; mental illness; HIV/AIDS; hepatitis; sexual risky behavior; being the victim of physical or sexual dating violence; experience of violence; and mental health and suicide risks [5–7]. Contextual factors such

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as socio-economic status, culture, religion, and minority or immigrant status do not usually receive enough attention in youth drug studies [8] though youth growing up in low-income, minority, and immigrant urban areas are particularly vulnerable to substance use as well as their negative health consequences [2, 9, 10]. In this study, we use social cognitive theory as a framework to study the association between micro-level predictor factors such as attitudes and behaviors of youth, friends, family, and adults, as well as socio-cultural factors and youth drug use in the low-income, immigrant, and ethnic community of Pomona, CA, USA.

This study addresses the dearth of studies which examine the association between youth drug use and micro-level factors such as socio-cultural factors, attitudes and behaviors among youths, their friends, their family, and other adults in Pomona California, USA. The results of the study will inform future modifications or design of youth drug use prevention programs in Pomona and add to the sparse literature on our understanding of unique evidence needs and unique youth prevention intervention design elements required for effective youth drug prevention programming in Pomona and other socio-economically and ethnically/racially diverse communities. We conducted an analysis of survey data on youth drug use collected 5 years after the implementation of the Pomona Youth and Family Master Plan (PYFMP) which was a community-wide intervention. PYFMP implemented a series of community-wide strategies and actions from 2006 to 2010 to address three selected priority risk factors including community disorganization, youth academic failure, and youth antisocial behavior [11]. While PYFMP carried out macro-level interventions and studies on Pomona youth drug use, there were no micro-level interventions and the influence of micro-factors on youth drug use has never been studied [12].

The use of PYFMP survey data for this analysis provided a unique opportunity for lessons to be learned that are useful today as they were more than a decade ago because the demographic and epidemiological profile of Pomona, the level of adversity and youth risk factors, and youth drug landscape have not changed significantly since 2009 [13–17]. In addition, though several new psychoactive substances including assynthetic cannabinoids, cathinones, and phenethylamines and synthetic opioids such as fentanyl-related compound have appeared on the drug sale market in recent years [18], including the deadly rise of opioid use [19, 20], common drugs of abuse such as crystal meth, ecstasy, cocaine, marijuana, and drug sales remain a dominant national and global public health problem which negatively affects families and society, and marijuana and prescription drugs are still the most commonly used among youths and they are both gateway drugs to other substances [20].

Literature Review

Social and Contextual Factors in Youth Drug Use

Youth substance use is socially determined and the documented predictors of youth drug use range from macro- (society), mezzo- (community), to micro- (friends and family) factors. The rise in youth drug use has been traced to micro-level factors such as parental and family functioning, schools, and peer influences; mezzo-level factors such as community systems, built environments, social organizations, and their activities; and macro-level factors including socio-economic, physical, and policy environments [9, 10, 21]. Though community-level intervention activities have had some impact on youth risk factors in Pomona [22–24] and have improved protective factors in multistate interventions for community, school, and peer/individual domains, but not in the family domain [25]; micro-level factors such as attitudes and behaviors of youth, friends, family, and adults, as well as socio-cultural factors, make important contributions to youth drug use behavioral outcomes [2, 26]. Also, findings in some studies imply that community-level interventions per se may have no effect on youth risk factors unless multiple micro-level players including the youth, their friends, and their families internalize the negative perceptions of risk factors [21].

Research has linked contextual factors such as personal characteristics, characteristics of the group people belong to, the social system, and the organizational and/or social climate they find themselves in to a variety of individual risks [27–29]. Contexts make unique contributions to youth risk factors that transcend micro-, mezzo-, and macro-factors so individual and family-level risk factors often depend on contextual factors [30]. The unique contributions of contextual factors in at-risk communities such as socio-economic status [31–33], culture, gender, age, religion, tradition, experience of racial discrimination, and minority and immigrant status [34, 35] are not usually given enough attention [8] in community-level interventions and studies though contextual factors are linked to poor youth outcomes and substance use disorders [30, 36, 37].

Micro-environmental Factors Associated with Youth Drug Use

The micro-level predictor variables adopted in the correlation and regression analyses in this study have been well documented in the literature as correlates of youth drug use. Many studies have identified key factors associated

with youth drug use behavior at the micro-level of analysis including attitudes and behaviors of family and other adults [2, 7, 26, 38]; attitudes and behavior of peers [2, 7, 26, 39]; individual characteristics such as age or gender [2] and individual youth behavior [7, 26, 40, 41]; socio-cultural factors such as affordability and easy access to drugs [2, 26, 41]; and perception of harms associated with drug use [7, 42].

Conceptual Framework: Social Cognitive Theory

The analysis of predictor and outcome variables in this study are framed within conceptual constructs in the social cognitive theory (SCT) which clarify the assumptions that drive the patterns of associations between youth drug use outcomes and micro-level factors associated with youth drug use. This framework also ties together identified predictors including youth individual characteristics and behavior; friends' attitudes and behavior; parental and adult attitudes and behavior; and socio-cultural factors; and highlights their interaction among themselves and with youth drug use outcomes.

Social cognitive theory (SCT) is rooted in personal factors, behavior, and environmental influences working together to lead to goals and behavioral change [43, 44]). SCT has been used to study the impact of environmental factors such as culture, media, and peers on drug use behavior as well as guide the design and evaluation of adolescent drug use prevention programs. Recent studies with SCT applications include the impact of films on students' drug use [45], influence of peers in social networks on the health behavior of drug users [46], and influence of reality TV and social media on college students' drug use [47]. SCT also guided the development and assessment of protocols for preventing substance use [48].

SCT constructs include the following: reciprocal determinism, behavioral capability, expectations, self-efficacy, observational learning, and reinforcements. The constructs of relevance to this study are reciprocal determinism, behavioral capability, self-efficacy, and reinforcements. Reciprocal determinism clarifies interactions between behavior (youth drug use), personal factors (e.g., individual youth behavior and attitudes), and micro-environment (which covers socio-cultural factors and the attitudes and behaviors of individual youth, friends, parents, and other adults). Behavioral capability states that, to perform a behavior, a person must know what to do and how to do it. Reinforcements are responses to behavior that affect whether one will repeat it. Positive reinforcements (rewards) increase a person's likelihood of repeating the behavior. Negative reinforcements may make repeated behavior less likely by motivating the person to eliminate a negative stimulus [43, 49]. Behavioral capability and self-efficacy represented by drug use behavior and reinforcements are enhanced by micro-level youth protective factors and can be undermined by micro-level risk factors discussed above. This multifaceted perspective of SCT inherent in reciprocal determinism is relevant to the dynamic relationships among personal, interpersonal, and socio-cultural factors which are associated with youth drug use in Pomona.

In terms of the study objectives and hypothesis, behavioral capability and self-efficacy are operationalized in youth drug use behavior. Reinforcements are operationalized in the predictor factors including individual youth characteristics, attitudes, and behavior; the behavior and attitudes of friends, adults, and peers; and socio-cultural factors such as affordability and access to drugs and perception of harms associated with drug use.

Study Objectives

The purpose of this study will be achieved through the following objectives guided by SCT:

1. Determine which predictor variables (reinforcements) related to individual youths, friends, family, adults, and socio-cultural factors are associated with youth drug use outcome variables (behavior capability and self-efficacy).
2. Determine the implications of the findings for youth drug use prevention intervention strategies (reinforcements).

Hypothesis

The hypothesis is driven by SCT constructs of relevance in this study. There will be correlations between predictor variables (reinforcements) including ease of access to drugs, attitudes and behaviors of youths and their friends, and the attitudes of parents and other adults in youth lives; and youth drug use outcome variables (behavior capability and self-efficacy) including marijuana use, drug sales, drinking in high school, cocaine use, ecstasy use, and crystal meth use.

Study Methods

Survey Design

This was a cross-sectional study of youth drug use among a high school convenient sample in Pomona, CA. The study relied on the Pride Survey Risk and Protective Factors Questionnaire [15, 50]. The data was collected after 5 years of

implementing the Pomona Youth and Family Master Plan (PYFMP).

City of Pomona Community Characteristics and Trends

Table 1 shows the demographics of the city of Pomona for the years 2009 and 2021, revealing a city with stable trends in population distribution, education, poverty, and health. Pomona ethnic distribution and socio-economic characteristics revealed a majority-minority population with high poverty and unemployment rates. In 2009 and 2021, poverty and unemployment rates in Pomona were higher than the US population overall [14]. The city had a population of 152,352 in 2009 and a land area of about 23 square miles compared to a population of 151,554 in 2021 [14]. In the period leading to 2009, children under 18 years made up 34% of the population compared to 24.7% in 2021. From 2009 to 2021, the city was afflicted by high levels of poverty, high prevalence and intensity of childhood disease burden, low academic performance, intractable gang violence, high teen pregnancy, teen substance abuse, low levels of health prevention resources, and barriers to healthcare access [14–17].

In addition, Los Angeles County Department of Public Health 2018 city and community profiles for Pomona showed stable demographic characteristics from 2010 to 2016, with 85% of the children eligible for subsidized school meals. Pomona residents were below the county average in poverty level; life expectancy; preschool enrollment; and third graders meeting California standards for language and arts literacy. Pomona also experienced lower levels of education, higher disease burden, higher levels of teen substance use, lower levels of health insurance, lower levels of employment, higher crimes and homicides, higher food insecurity, and easy access to alcohol and other substances compared to the rest of Los Angeles County [17].

Table 1 Pomona 2009 population characteristics

Year	2009	2022
Population (*N*)	152,359	151,554
Sample size (*n*)	2693	N/A
Ethnic distribution		
Total	152,359	151,554
Latino%	70.50	71.4
White%	12.5	10.34
Black%	7.3	5.9
Asian%	8.3	10.8
Some other%	1.2	2.4
Gender (*n*)	152,359	151,554
Male	47.8	49.1
Female	52.2	50.9
Median household income ($)	48,973	67,549
Below 100% poverty rate (%)	17.7	16.4
Unemployment rate (%)	11.7	5.8
High school graduates	25	24.4
Lack of access to healthcare	23	12.5

Participants

The study sample was drawn from the population of youths in the Pomona Unified School District (PUSD). In 2009, the PUSD reported a student population of 31,817 with 49% or 15,630 in 6th to 12th grade. The student ethnic composition was as follows: 80.1% Hispanic, seven percent African American, six percent White, six percent Asian/Pacific Islander/Filipino, and six percent other ethnic groups combined. About three-quarters of PUSD students qualified for the compensatory education program; 52% qualified for free or reduced lunch; 45% were English language learners; and the high school dropout rate was 29%, making it the 4th highest in California [15].

Sample Characteristics

A convenient sample was used in this study and it was made up of all the students in the 8th, 10th, and 12th grades of the Pomona Unified School District (PUSD) which was the only high school in Pomona. From the 6000 surveys administered to Pomona School District high school students, 2693 students participated in the study. Participant demographics were as follows: White (4.3%), African American (5.3%), Hispanic/Latino (71.31%), Asian Pacific Islander (7.9%), Native American (0.6%), mixed origins (5.0%), and other (2.3%). Male (46%); female (54%).

Data Collection

Information on youth drug use was collected through the Pride Survey Risk and Protective Factors Questionnaire developed and administered in collaboration with external consultants and university-based researchers. The Pride Survey is an adaptation of the Communities That Care (CTC) Survey.

The survey was distributed via direct mailing to the homes of all students in the 8th, 10th, and 12th grades of Pomona High School. The students completed the survey at home and returned the completed surveys by mail or in person at the school administrative offices. In December 2010, the PUSD community relations office mailed 6000 hard copies of the Pride Survey to all Pomona Unified School District students in grades eight, ten, and twelve. Of the 6000 surveys sent out to students, 2693 surveys were completed and

returned. One hundred and eleven additional surveys were returned but not completed.

Ethics Compliance

To participate in the survey, students must be residents of the city of Pomona, willing to complete the survey anonymously, and their parents or guardians must have completed the passive consent form. The pride protective risk factors survey was given under the auspices of a passive permission approach whereby parent permission was not needed at the 8th, 10th, and 12th grades for each survey students complete during the school year. This is because at the beginning of the school year, parents sign a consent form for the students to participate in school surveys during the school year without additional parental consent. In addition, the students were given verbal and written instructions with the understanding that participation in the survey was voluntary. A general notice also went to the parents from the school district office regarding the survey before it was mailed to students. The confidentiality of the students responding to questionnaires was protected because the students were not allowed to write their names or any unique identifier on the questionnaires. Students were instructed not to include identifying marks. Any questionnaires with identifying marks were shredded and not included in the data. All instructors who explained the survey or answered questions on the survey to students or parents were trained in human subjects protection protocols.

Measurements

Youth drug use was measured using the Pride Survey Risk and Protective Instrument which has been widely used by evaluators of adolescent programs to measure youth risk and protective factors (Hawkins, 1992, 1999). The predictor variables listed below have been identified in the "Literature Review" section above. The pride survey has also been successfully validated. The pride survey questions regarding youth substance have been found to be valid [51, 52]; to be reliable (test–retest coefficients from 0.814–0.851; [51]; and to have a high interrater agreement (80%) regarding survey question content between survey responders [53]. A comparison of the Pride Survey estimates with the Monitoring the Future survey found similar estimates between the surveys [54].

Outcome variables related to youth drug use were measured by questions in the following nine areas as outlined in the outcome columns of Tables 3 and 4: age of first use of marijuana; drug sales in the past year; drunk or high in school in the past year; marijuana use in the past year; cocaine use in the past year; ecstasy use in the past year; crystal meth use in the past year; marijuana use in the past 30 days; and cocaine use in the past 30 days. As described below and outlined in the predictor column of Table 3, predictor variables which were found to be associated with outcome variables with a weak to medium coefficient of correlation and statistical significance of 0.00001 or below were measured by questions in the areas described below and listed in Table 3. Areas covered by questions included drug use behavior of best friends, antisocial behavior of best friends, prosocial behavior of best friends, youth school–related antisocial behavior, participant attitude towards antisocial behavior, participant perception of harm from drug use, ease of access to drugs, participants perceived risk of being caught by parents when drinking or carrying a handgun, adult attitudes towards youth substance use, and parental attitudes towards youth substance use.

Examples of questions and response options are:

Question: Fourfriends23b. In the past year, how many of your best friends tried beer, wine, or hard liquor when their parents did not know?
Response options: 0 = other, 1 = none of my friends, 2 = 1 of my friends, 3 = 2 of my friends, 4 = 3 of my friends, 5 = 4 of my friends.

The final output of multiple regression analysis is reported in Table 5 in the "Results" section.

Outcomes and predictor variables listed in Table 4 below were not derived from the results of correlations analysis but were put together based on evidence in the literature in order to allow for a single-factor regression analysis centered on participant antisocial and prosocial behavior. Antisocial predictor factors included age of first arrest, age of first handgun, age of first attack with intention to hurt someone, age of first gang membership, number of times youth carried gun in the past year, number of times involved in motor vehicle theft in the past year, number of times arrested in the past year, and number of times attacked in the past year. Prosocial behaviors included the number of times youth participated in clubs, organizations, and activities in the past year, and the number of times youth volunteered for community services in the past year. Predictor and outcome variables are fitted into multiple regression models with final outputs reported in Table 6 in the "Results" section.

Data Analyses

We performed an exploratory analysis of youth drug use outcomes and predictors including Spearman's correlations and multiple regression analysis. Spearman's rank-order correlations were used to assess pairwise associations between ordinal outcome variables and potential predictors. Multiple regression analyses were performed

to jointly assess factors associated with youth drug use. To control false positive rates associated with numerous hypothesis tests, a Bonferroni-adjusted significance level of 0.00001 was used in correlation analysis.

Spearman's rank-order correlation statistic allows for the assessment of the association between two ordinal variables (most variables in this study are at this level of measurement). In particular, when statistically significant, the direction (positive or negative) of the correlation between the two variables can provide relevant understanding. With such a large number of correlations being examined, at the usual 0.05 significance level, it would be expected that 1 in 20 would come back as statistically significant even in a scenario where there were no real associations whatsoever. To avoid the potentially inflated false positive rate, we used a Bonferroni-adjusted significance level of 0.00001 when determining significant *p*-values. We did not use Pearson's correlation because this type of correlation is used for variables with normal distribution and the data are quantitative. The variables in this study are predominantly ordinal [55]).

In the second step, several multiple linear regression models were developed based on predictors and outcome variables which showed statistically significant pairwise associations where weak to medium correlation coefficients had been found (see Table 5). In Table 6, additional regression models were developed from a set of youth drug outcomes and predictors related to youth antisocial and prosocial behaviors. The regression models were used to identify potential sets of useful predictors of different outcome variables related to youth drug use.

For all models, we used the "backward elimination" method to select the best predictors to incorporate in final models. As this is an exploratory study, for the final models (Tables 5 and 6), we retained all variables in the model for which the *p*-value was found to be less than 0.05, as well as at most one additional variable having *p*-values between 0.05 and 0.15. We also report the coefficient of determination (R^2), which estimates the proportion of variation in the outcome variable that is explained by the statistical model [56–58], and the frequency with which each variable or factor appeared in the different models in the analysis.

Results

Summary of Results.

In the "Results" section, we report on the prevalence of youth drug use among study participants, description of regression models, the predictors associated with youth drug use, and variations in predictability across regression models.

Summary of Reported Youth Substance Use

Table 2 is a report of the incidence of youth drug use among participants in the pride survey administered in 2010 to PUSD high school students.

Table 2 presents the proportion of drug use among the youth sample in the study by grade and drug. The incidence of drug use is highest for marijuana and lowest for oxycontin. Pomona youth drug use in 2010 mirrors national trends in the past two decades. Nationally, though several new psychoactive substances have appeared on the drug sale market in recent years [59], including the deadly rise of opioid use [20], common drugs of abuse such as crystal meth, ecstasy, cocaine, marijuana, and drug sales remain a dominant national and global public health problem which negatively affects families and society [20]. Marijuana and prescription drugs are most commonly used among youths and they are both gateway drugs to other substances [20].

Results from Spearman's Correlation and Regression Analysis

Both Spearman's correlation and regression analyses reveal a stronger association between youth drug use and factors related to participants and friends relative to the association between youth drug use and factors related to parents and adults.

Tables 3 and 4 are described in detail in the "Measurements" and "Data Analyses" sections above. Table 4 contains the authors identified predictor variables used in regression analysis and reported in Table 6. Table 3 presents the results of the Spearman correlation analysis. We summarize the main takeaways from Spearman's correlation analysis results reported in Table 3 and fitted in

Table 2 Youth drug use percentages by grade 2010

Measure ($n=2693$)	8th	10th	12th	Total
Marijuana	18.40%	24.30%	31.60%	23.20%
Cocaine	2.80%	1.00%	4.90%	3.70%
Uppers	4.80%	5.90%	6.40%	5.50%
Downers	8.70%	11.70%	7.80%	9.40%
Inhalants	7.20%	6.70%	4.20%	6.40%
Hallucinogens	1.70%	3.60%	4.00%	2.80%
Heroine	1.50%	2.00%	1.90%	1.70%
Anabolic steroids	1.20%	1.30%	0.50%	1.10%
Ecstasy	6.30%	10.20%	11.30%	8.30%
Oxycontin	0.80%	1.90%	2.00%	1.40%
Crystal meth	3.30%	3.30%	3.20%	3.30%

Table 3 Predictors associated with youth drug outcome variables

Outcome	Predictor variables/coeff. corr *R*
Marijuana (age of first use)	1. Friends smoking cigarettes (− .0.367) 2. Friends tried beer or liquor (− .0.435) 3. Friends using marijuana (− .0.564) 4. Friends using lysergic acid diethylamide (LSD) cocaine, methamphetamines(meth), or other illegal drugs (− .0.358) 5. Friends suspended from school (− .0.291) 6. Friends carried a handgun (− .0.336) 7. Friends sold illegal drugs (− .0.441) 8. Friends stole or tried to steal motor vehicle (− .0.251) 9. Friends participate in clubs, organizations, or activities (− .0.372) 10. Friends made commitment to stay drug-free (− .0.249) 11. Friends have liked school (− 0.312) 12. Friends dropped out of school (− .0.260) 13. Wrong to steal something worth more than $5 (− .0.291) 14. Wrong to pick a fight with someone (− 0.273) 15. Wrong to attack someone with intention to seriously hurt (− .0.310) 16. Wrong to stay away from when parents don't know (− .0.417) 17. Wrong to drink beer, wine, or hard liquor regularly (once or twice a month) (− 0.377) 18. Wrong to smoke cigarettes (− 0.577) 19. Wrong to use LSD, meth, or other illegal drugs (− 0.351) 20. Perception of risk of harm from smoking marijuana once or twice (0.326) 21. Perception of risk of harm from smoking marijuana regularly (0.340) 22. Ease of availability of wine, beer, or hard liquor (− 0.291) 23. Ease of availability of cigarettes (− 0.337) 24.Ease of availability of marijuana (− 0.410) 25. Ease of availability of LSD, cocaine, or meth (− 0.253) 26. Perceived risk of being caught by parents if drinking beer, wine, or liquor (0.278) 27. Perceived risk of being caught by parents if you carried a handgun (0.262) 28. How wrong adults perceive youth marijuana use (− 0.324) 29. How wrong adults perceive youth cigarette smoking(0.270)
Drug sales past year	1. Friends using marijuana (0.329) 2. Friends carried a handgun (0.373) 3. Friends sold illegal drugs (0.451 4. Friends have stolen or tried to steal motor vehicles (0.258) 5. Friends participated in clubs, organization or activities (0.312) 6. Wrong to stay away from school all day when parents don't know (0.254) 7. Wrong to smoke cigarettes (0.337) 8. Wrong to use LSD, cocaine, meth, other drugs (0.281) 9. Ease of access to marijuana (0.253)
Drunk or high at school past year	1. Friends tried beer or hard liquor when parents did not know (0.38) 2. Friends used marijuana (0.43) 3. Friends used LSD, cocaine, meth, and other drugs (0.32) 4. Friends suspended from school (0.25) 5. Friends carried a handgun (0.29) 6. Friends sold illegal drugs (0.40) 7. Friends liked school (.31) 8. Wrong to take a handgun to school (.31) 9. Wrong to steal something worth more than $5 (.25) 10. Wrong to pick a fight with someone (.30) 11. Wrong to pick a fight with someone (0.28) 12. Wrong to attack to seriously hurt (0.31) 13. Wrong to stay away from school when parents don't know (0.40) 14. Wrong to drink beer, wine or hard liquor (once or twice a month) (0.40) 15. Wrong to smoke cigarettes (0.48) 16. Wrong to use LSD, cocaine, meth, other drugs (− .32) 17. Perception of risk of harm from smoking marijuana regularly (0.28) 18. Ease of access to marijuana (0.30) 19. How wrong adults perceive underage marijuana use (0.25)

Table 3 (continued)

Outcome	Predictor variables/coeff. corr *R*
Marijuana Use Past Year	1. Friends smoked cigarettes (0.35) 2. Friends tried beer or hard liquor (0.41) 3. Friends have used marijuana(0.54) 4. Friends have used LSD, cocaine, meth, or other drugs (0.34) 5. Friends suspended from school (0.26) 6. Friends carried a handgun (0.28) 7. Friends have sold illegal drugs (0.41) 8. Friends have participated in clubs, organizations, or activities (0.34) 9. Friends have liked schools (0.29) 10. Friends have dropped from schools (− 0.27) 11. Wrong to steal something worth more than $5 (0.27) 12. Wrong for someone to take a handgun to school (0.29) 13. Wrong to pick a fight with someone (0.250) 14. Wrong to attack someone with an idea of seriously hurting (0.30) 15. Wrong to stay out of school when parents don't know (0.40) 16. Wrong to drink wine or hard liquor regularly (1 × month) (0.37) 17. Wrong to smoke cigarettes(.60) 18. Wrong to use LSD, cocaine, meth, or other illegal drugs (0.32) 19. Perception of risk of harm from smoking marijuana once or twice (− 0.32) 20. Perception of risk of harm from smoking marijuana regularly (0.32) 21. Ease of access to wine or beer (0.27) 22. Ease of access to cigarettes (0.32) 23. Ease of access to marijuana (0.41) 24. How wrong parents perceive underage marijuana use (0.30) 25. Perceived risk of being caught by parents if drinking wine or beer (0.25) 26. How wrong adults perceive underage marijuana use (0.33)
Cocaine use Past Year	1. Friends use of marijuana (0.23) 2. Friends use of LSD, cocaine, meth, and other illegal drugs (0.31) 3. Friends carried a handgun (0.25)
Ecstasy use Past Year	1. Friends tried beer or liquor when parents did not know (0.26) 2. Friends used marijuana (0.32) 3. Friends used LSD, cocaine, meth, and other illegal drugs (0.32) 4. Friends suspended from school (0.28) 5. Friends sold illegal drugs (0.31) 6. Friends participated in clubs, organizations, or activities (0.25) 7. Wrong to stay away from school when parents don't know (0.27) 8. Wrong to smoke cigarettes (0.30) 9. Wrong to smoke LSD, cocaine, meth, and other illegal drugs (28)
Crystal meth use past year	1. Friends used marijuana (0.25) 2. Wrong to use LSD, cocaine, meth and other illegal drugs (0.26)
Marijuana use past 30 days	1. Friends smoked cigarettes (0.31) 2. Friends smoked beer or liquor when parents did not know (0.35) 3. Friends used marijuana (0.50) 4. Friends used LSD, cocaine, meth, or other illegal drugs (0.30) 5. Friends have been suspended from school (0.25) 6. Friends have carried handgun (0.29) 7. Friends have sold illegal drugs (0.41) 8. Friends have participated in clubs, org, or activities (0.33) 9. Wrong to steal something worth more than $5 (0.25) 10. Wrong to take a handgun to school (0.28) 11. Wrong to pick a fight with someone (.26) 12. Wrong to attack with idea to seriously hurt (0.26) 13. Wrong to stay away from school when parents don't know (0.37) 14. Wrong to drink beer, wine, or hard liquor (0.35) 15. Wrong to smoke cigarettes (0.55) 16. Wrong to use LSD, cocaine, meth, or other illegal drugs (0.34) 17. Perception of risk of harm from smoking marijuana once or twice (− .292) 18. Perception of risk of harm from smoking marijuana regularly (− .334) 19. Ease of access to marijuana (.0.359) 20. How wrong parents perceive underage cigarette smoking (0.31) 21. How wrong adults perceive underage marijuana use (.30)
Cocaine 30 days	1. Wrong to use LSD, cocaine, meth, or other illegal drugs(0.26)

Table 4 Antisocial and prosocial behaviors as predictors of youth drug use

Outcome variables (youth drug outcomes)	Predictor variables (antisocial and prosocial behaviors)
1. Marijuana use past year	1. Age of first arrest
2. Cocaine past year	2. Age of first handgun carry
3. Ecstasy past year	3. Age of first attack with intention to hurt someone
4. Crystal meth past year	4. Age of first gang membership
5. Marijuana 30 days	5. Number of times carried gun in the past year
6. Cocaine 30 days	6. Number of times involved in Motor Vehicle theft in past year
	7. Number of times arrested in the past year
	8. Number of times attacked with intention to hurt in the past year
	9. Number of times participated in clubs, organizations, activities in the past year
	10. Number of times volunteer for community services in the past year

Table 5 regression models. The following predictor factors were associated with youth drug behavior outcome variables: individual use behavior of best friends; antisocial behavior of best friends; prosocial behavior of best friends; youth school–related antisocial behavior; participant attitude towards antisocial behavior; participant perception of harm from drug use; ease of access to drugs, participants perceived risk of being caught by parents when drinking or carrying handgun; adult attitudes towards youth substance use; and parental attitudes towards youth substance use. Negative or positive coefficients of correlation indicate negative or positive associations respectively. There were higher coefficients of correlations (0.4 to 0.6) in the association between youth drug use and factors related to participants, their friends, and ease of access to drugs, and perceived harm from drugs relative to the association between youth drug use and factors related to parents and adults (0.25 to 0.33).

Table 5 presents multiple regression models derived from drug use outcome variables and predictors from Spearman's correlation results listed in Table 3 while Table 6 contains authors identified drug outcome variables and antisocial and prosocial variables listed in Table 4. The response column indicates which outcome variable is being considered. The outcome variables in Tables 5 and 6 include the following: age of first use of marijuana; drug sales in the past year; drunk or high in school in the past year; marijuana use in the past year; cocaine use in the past year, ecstasy use in the past year; crystal meth use in the past year; marijuana use in the past thirty days; and cocaine use in the past 30 days.

We also report the coefficient of determination (R^2), which estimates the proportion of variation in the outcome variable that is explained by the regression model [56–58], and the frequency with which each variable or factor appeared in the different models in the analysis. The prediction R^2 is a vague measure of the overall predictive ability of the model (expressed as a percentage, with larger values being better models in the predictive sense). The model summary column contains all variables remaining in the model after model selection (p-values < 0.05, with potentially one additional variable with p-value 0.05–0.15).

Predictors with Statistically Significant Associations with Youth Drug Use

The distribution of the factors associated with outcome variables in regression models listed in Tables 5 and 6 is described below.

Table 5 results suggest that the attitudes, perceptions, and behavior of peers, participants, family, and adults in the participants' life, and ease of access to drugs are associated with youth drug use. Factors related to friends include the following: drug behavior of best friends; antisocial behavior of best friends; and prosocial behavior of best friends. Factors related to participants included the following: participant's attitude towards antisocial behavior; participant's perception of risk associated with drug use; participant's ease of access to drugs; participant's antisocial behavior; and participant's perception of risk of being caught by parents. Factors related to adults and parents included the following: adult attitudes towards youth substance; and parental attitudes towards youth substance use. Furthermore, based on how often they appear in regression models, variables related to friends and participants have a relatively stronger association with youth drug use than variables related to parents and adults in participants' lives. In addition, drug and non-drug antisocial behavior of peers and participants have a relatively stronger association with youth drug use than prosocial behavior.

It is useful to review the commonality among models here. Factors related to best friends appeared in different models as follows: drug behavior of best friends which appeared in eight of the nine regression models; antisocial behavior of best friends which appeared in seven of the nine regression models; and prosocial behavior of best friends which appeared in five of the nine models. Among factors related to participants, only participants' attitudes towards antisocial behavior appeared in a majority of models (eight of nine). Other components were not

Table 5 Multiple regression models 1.1 to 1.9 fits from drug outcomes variables and predictor 1

Outcome and prediction R^2	Model terms and coefficients			
	Term	Coef	SE coef	*P*-value
Model 1.1				
Marijuana (age of first use) $R^2 = 28.4\%$	Friends smoked marijuana	−0.257	0.0371	0.000
	Friends carried handgun	−0.1581	0.0774	0.041
	Friends have stolen or tried to steal motor vehicle	0.2136	0.0892	0.017
	Friends participated in clubs, organizations, or activities	−0.2451	0.0636	0.000
	Friends have made commitment to stay drug-free	0.1815	0.0665	0.006
	Friends liked school	−0.403	0.0488	0.004
	Friends dropped out of school	0.1784	0.0271	0.000
	Wrong to pick a fight with someone	0.1142	0.0502	0.023
	Wrong to attack someone with the idea of seriously hurting them	0.2016	0.0609	0.001
	Wrong to drink beer, wine, or hard liquor	0.1227	0.0631	0.052
	Wrong to smoke cigarettes	−0.5823	0.0643	0.000
	Perception of risk of harm from smoking marijuana once or twice	0.2614	0.0399	0.000
	Ease of availability of marijuana	−0.0915	0.0367	0.013
	Perceived risk of being caught by parents when you drink beer, wine, or liquor	0.1160	0.0504	0.021
	Perceived risk of being caught by parents if you carried a handgun	0.2054	0.0481	0.000
	How wrong adults perceive underage marijuana use	−0.2334	0.0781	0.003
	How wrong adults perceive underage alcohol drinking	0.1375	0.0698	0.049
Model 1.2				
Drug sales past year $R^2 = 22.1\%$	Friends have used marijuana	−0.0291	0.0147	0.048
	Friends have carried guns	0.1997	0.0261	0.000
	Friends have sold illegal drugs	0.2402	0.0222	0.000
	Wrong to stay away from school when parents don't know	0.0331	0.0199	0.098
	Wrong to smoke cigarettes	0.1053	0.0240	0.000
	Wrong to use LSD, cocaine, meth, other illegal drugs	0.1333	0.0271	0.000
Model 1.3				
	Term	Coef	SE coef	*P*-value
Drunk or high at school past year $R^2 = 27.4\%$	Friends tried beer or hard liquor	0.0466	0.0164	0.004
	Friends have carried a handgun	0.1727	0.0357	0.000
	Friends have sold illegal drugs	0.1587	0.0287	0.000
	Friends have liked school	0.0632	0.0230	0.006
	Wrong to stay away from school when parents don't know	0.0677	0.0274	0.014
	Wrong to smoke cigarettes	0.3904	0.0278	0.000
Model 1.4				
Marijuana use past year $R^2 = 42.8\%$	Friends tried beer or hard liquor	0.0391	0.0222	0.079
	Friends used marijuana	0.2434	0.0272	0.000
	Friends suspended from school	−0.0537	0.0236	0.023
	Friends sold illegal drugs	0.1131	0.0358	0.002
	Friends made commitments to stay drug-free	0.1505	0.0368	0.000
	Wrong to take handgun to school	0.0959	0.0342	0.005
	Wrong to pick a fight with someone	−0.1557	0.0387	0.000
	Wrong to attack someone with idea of seriously hurting	−0.0961	0.0389	0.014
	Wrong to drink beer, wine, or hard liquor	−0.1890	0.0401	0.000
	Wrong to smoke cigarettes	0.8240	0.0406	0.000
	Perception of risk of harm from smoking marijuana	−0.1119	0.0211	0.000
	Ease of access to wine, beer, or hard liquor	−0.06667	0.0345	0.053
	Ease of access to cigarettes	0.1279	0.0338	0.000
	How wrong parents perceived cigarette smoking	0.1667	0.0419	0.000

Table 5 (continued)

Outcome and prediction R^2	Model terms and coefficients			
	Term	Coef	SE coef	*P*-value
Model 1.5				
	Term	Coef	SE coef	*P*-value
Cocaine use past year $R^2 = 10.9\%$	Friends used LSD, cocaine, meth, or other illegal drugs	0.1262	0.0128	0.000
	Friends have been suspended from school	0.1770	0.0180	0.000
Model 1.6				
Ecstasy use past year $R^2 = 14.4\%$	Friends have used marijuana	0.0525	0.0154	0.001
	Friends have used LSD, cocaine, meth, or other illegal drugs	0.0825	0.0219	0.000
	Friends carried a handgun	0.0730	0.0288	0.011
	Friends sold illegal drugs	0.0536	0.0245	0.029
	Friends participated in clubs, organizations, and activities	0.0393	0.0242	0.015
	Wrong to stay away from school all day when parents don't know	0.0880	0.0187	0.000
	Wrong to use LSD, cocaine, meth, and other drugs	0.1484	0.0260	0.000
Model 1.7				
Crystal meth use past year $R^2 = 8.4\%$	Friends have used marijuana	0.04405	0.00711	0.000
	Wrong to use LSD, cocaine, meth, or other illegal drugs	0.1682	0.0136	0.000
Model 1.8				
Marijuana use 30 days $R^2 = 32.9\%$	Friends have used marijuana	0.1456	0.0217	0.000
	Friends have used LSD, cocaine, meth, or other drugs	−0.0606	0.0292	0.038
	Friends have carried a gun	0.1234	0.0382	0.001
	Friends have sold illegal drugs	0.1217	0.0325	0.000
	Friends have participated in clubs, organizations, or activities	0.0585	0.0321	0.068
	Wrong to drink wine, beer, or hard liquor	−0.1009	0.0338	0.003
	Wrong to smoke cigarettes	0.4410	0.0349	0.000
	Wrong to use LSD, cocaine, meth, or other illegal drugs	0.0970	0.0401	0.016
	Perceived risk of harm from smoking marijuana	−0.0655	0.0177	0.000
	Ease of availability of marijuana	0.0563	0.0192	0.003
	How wrong parents perceive underage marijuana smoking	0.2189	0.0358	0.000
Model 1.9	Coefficients			
Cocaine use 30 days $R^2 = 7.8\%$	Wrong to use LSD, cocaine, meth, or other illegal drugs	0.1893	0.0122	0.000

as prevalent. Participants' perceptions of risk associated with drug use and participants' ease of access to drugs both appeared in the same three models (1.1, 1.4, and 1.8). Participant's antisocial behavior and participant's perception of the risk of being caught by parents both appeared in model 1.1 only. Likewise, factors related to parents and adults in the participants' lives were included as follows: adult attitudes towards youth substance (model 1.1 only) and parental attitudes towards youth substance use (models 1.4 and 1.8). With regard to factors related to the use of drugs, appearance in different models was as follows: factors related to marijuana appeared in six of nine models; factors related to LSD, meth, cocaine, and other illegal drugs appeared in seven models out of nine; factors related to cigarette smoking appeared in three out of nine models; and factors related to beer, liquor, and wine appeared in five out of nine regression models.

Table 6 results suggest that the antisocial behavior of peers and participants has a relatively stronger association with youth drug use than prosocial behavior. Table 6 contains models 2.1 to 2.6 fitted exclusively with predictor variables related to participants' antisocial and prosocial behavior. Between 4 and 7 variables related to a participant's antisocial behavior appeared in models 2.1–2.5. Only one or two variables related to a participant's prosocial behavior appeared in these same five models.

Variations in Predictability

All regression models in the study demonstrated some outcome variable predictability. Also, when a diverse set of predictor variables are combined together, their association to the outcome variable is stronger than that of a single variable. R^2 values were consistent with observations in similar

Table 6 Model 2.1 to 2.6: youth drug use outcomes and antisocial and prosocial behaviors as predictors

Outcome and prediction R^2	Model terms and coefficients			
	Term	Coef	SE coef	*P*-value
Model 2.1				
Marijuana use past year $R^2 = 13.9\%$	First arrest	−0.0790	0.0219	0.000
	First handgun carry	0.0471	0.0217	0.030
	First attack with intention to hurt someone	−0.0741	0.0174	0.000
	Number of times carried a gun	0.4502	0.0536	0.000
	Number of times arrested	0.2832	0.0666	0.000
	Numbers of times attacked with intention to hurt	0.2665	0.0439	0.000
	Number of times volunteered for community service	−0.0372	0.0176	0.035
Model 2.2				
Cocaine use past year $R^2 = 16.5\%$	Age of first arrest	0.03275	0.00759	0.000
	Age of first handgun carry	−0.02114	0.00743	0.004
	Number of times carried gun	0.1913	0.0193	0.000
	Number of times arrested	0.2572	0.0238	0.000
	Number of times attacked with intention to hurt	0.0582	0.0146	0.000
	Number of times participated in clubs, organizations, and activities	0.01500	0.00522	0.004
Model 2.3				
Ecstasy use past year $R^2 = 8.7\%$	Age of first arrest	−0.0464	0.0117	0.000
	Age of first attack with intention to hurt someone	−0.01737	0.00934	0.063
	Age of first gang membership	0.0335	0.0120	0.005
	Number of times carried guns	0.2125	0.0325	0.000
	Number of times involved in motor vehicle theft	−0.0998	0.0403	0.013
	Number of times arrested	0.2234	0.0388	0.000
	Number of times attacked	0.1198	0.0237	0.000
	Number of times participated in clubs, organizations, and activities	0.02696	0.00912	0.003
	Number of times volunteered for community services	−0.0249	0.0111	0.025
Model 2.4				
Crystal meth use past year $R^2 = 8.4\%$	Age of first arrest	0.1213	0.092	0.000
	Number of times carried gun	−0.0429	0.0238	0.071
	Number of times arrested	0.1374	0.0223	0.000
	Number of times attacked	0.0772	0.0128	0.000
	Number of times participated in clubs, organizations, and activities	0.01394	0.00453	0.002
Model 2.5				
Marijuana use past 30 days $R^2 = 15.9\%$	Age of first arrest	−0.0378	0.0170	0.028
	Age of first attack with intention to hurt someone	−0.0608	0.0135	0.000
	Age of first gang membership	0.0330	0.0174	0.057
	Number of times carried gun	0.0597	0.0408	0.000
	Number of times arrested	0.3660	0.0513	0.000
	Number of times attacked with intention to hurt	0.1858	0.0342	0.000
	Number of times volunteered for community services	−0.0294	0.0137	0.032
Model 2.6	Coefficients			
Cocaine use 30 days $R^2 = 13.2\%$	Age of first arrest	0.01206	0.00596	0.043
	Age of first gang membership	0.01069	0.00604	0.077
	Number of times carried guns	0.1409	0.0173	0.000
	Number of times involved in motor vehicle theft	0.0649	0.0214	0.002
	Number of times arrested	0.1302	0.0202	0.000
	Number of times attacked with intention to hurt	0.0449	0.0116	0.000

studies in the literature. Coefficients of determination in psychological studies and related fields in human behavior usually have R^2 values which are consistently below 0.5 [60–62]). Using the experience in similar studies and suggestions in the literature, we adopted the following rule of thumb for interpreting R^2 values: R^2 values ranging from above 0.0–0.3, 0.3–0.5, and 0.5 or more are respectively considered as small, medium, and large with regard to the predictive ability of the model [58, 63].

Based on the authors' adopted guidelines, the outcome variable predictability of the models listed in Table 5 included small and medium outcome variable predictability. Consistent with other behavioral or related studies, no model in Table 5 had large outcome variable predictability. R^2 values range from 7.8 to 42.8% for Table 5 models. Table 5 has eight models with small outcome variable predictability including models 1.1, 1.2, 1.3, 1.4, 1.5, 1.7, 1.9, 1.6. Model 1.8 has a medium outcomes variable predictability.

All six models in Table 6 had small outcome variable predictability. R^2 values ranged from 8.4 to 16.9% for Table 6.

Discussion

Summary

In this study, we seek to understand the association between micro-level predictor factors including individual, interpersonal, and socio-cultural factors and youth drug use in the low-income, immigrant, and ethnic community of Pomona, CA, USA in order to unearth the unique elements needed for effective youth drug use prevention program development. We analyzed PYFMP survey data on youth drug use behavior collected after 5 years of implementation using Spearman's correlation and multiple regression in order to identify potential predictors of different outcome variables related to youth drug use. The results of the analyses support the study hypotheses and suggest that micro-level factors are associated with youth drug use.

Relative Strength of Association with Youth Drug Use Behavior Among Predictor Variables

The value of the coefficient of correlation in Spearman's correlation analysis, the distribution of predictor variables and factors, and the value of the coefficient of determination in the different regression models help to identify variables and factors which might be most associated with youth drug use outcomes. In Spearman's correlation analysis, some predictor factors show stronger associations to outcome variables based on the strength of their coefficients of correlation while some factors might be more associated with outcome variables than others based on how often they appear in different regression models. Also, when a diverse set of predictor variables or factors (Table 5, models 1.1 to 1.8) are combined together, their association to the outcome variable is stronger than that of a single variable or factor (Table 5 model 1.9; Table 6, models 2.1 to 2.6). Also, the consistency in the frequency of these variables or factors across models and the alignment of patterns in regression analysis to the results from Spearman's correlation analysis underscore the reliability of the study methods and findings. These three findings might provide guidance for future planning, implementation, and evaluation of youth drug use prevention plans particularly in terms of prioritizing intervention activities.

Results of Spearman's correlation analysis show higher coefficients of correlations in the association between youth drug use and factors related to participants, their friends, and ease of access to drugs, and perceived harm from drugs relative to the association between youth drug use and factors related to parents and adults. Likewise, predictor variables or factors related to best friends and participants appear in Table 5 regression models than factors related to parents and adults in participants' lives. With regard to predictor variables or factors related to best friends and participants, drug use behavior of best friends, best friends' antisocial behavior, best friends' prosocial behavior, and participant's attitude towards antisocial behavior are four factors which appear with more frequency in the different Table 5 models than all other factors related to friends and participants. In examining predictor variables and factors related to substance use behavior, factors related to the following: marijuana; LSD, cocaine, meth, and other illegal drugs; and beer, wine, and liquor; appear in more models than factors related to smoking cigarettes. In Table 6, variables related to participant antisocial behavior appear more often in models than variables related to participant prosocial behavior.

The strength of coefficients of correlation in Spearman's correlation analysis and the frequency with which predictor variables or factors appear in regression models have practical implications for the design of prevention interventions. Youth drug prevention planners in Pomona should consider prioritizing intervention activities which target variables and factors with strong coefficients of correlation and showing higher frequency in regression models such as factors related to behaviors, attitudes, and perceptions of friends and participants over parents and adults. Equally, activities targeting antisocial behavior should be prioritized over prosocial behaviors.

Combined Effect of Predictor Factors

In combination, multiple factors seem to explain a greater proportion of dependent variables than a single variable.

Models fitted with predictor variables from a wide range of factors accounted for more of the variance in the outcome variable than models fitted with variables from a single factor. For instance, models in Table 6 were fitted exclusively with predictor variables related to a single factor, participant antisocial behavior, and prosocial behavior. The models predominantly had small outcome variable predictability. On the other hand, models in Table 5 were fitted with variables related to a variety of factors concerning friends, participants, adults, and parents. Table 5 has one model with a medium outcome variable predictability and 8 models with small outcome variable predictability. These findings seem to suggest that the greater the number of predictor factors targeted in a youth drug use intervention, the more likely it might be that the interventional activities would be associated with youth drug use outcomes.

Relationship of Findings to the Literature

The findings in this study align with existing literature in many ways. They also break from and add to the current literature on youth drug use as described below.

There are many alignments between the findings in this study with contemporary scholarship on youth drug use. The basic findings of associations between several micro-level predictor factors and youth drug use outcomes affirm findings in the existing literature which report associations between youth drug use and the following micro-level factors: attitudes and behaviors among peers [26, 64]; attitudes of family and adults in participants' lives [2, 7, 26, 38]; ease of access to drugs [26, 41]; and risk perceptions, attitudes, and behavior of participants [7, 26, 42]. Furthermore, the findings showing that a combination of multiple predictor factors shows a stronger association to drug use outcomes than a single factor align with the literature on youth drug use which suggests that ideal interventions to prevent youth substance use should combine multiple factors [21, 65–67].

The relative strength of association with youth drug outcomes among predictor factors related to friends, participants, and antisocial behaviors represented by how often they appear on different models in this study introduces a dimension not addressed in most studies on the associations between youth drug use and micro-level predictors cited above [2, 38, 64]. The findings in this study revealed that the attitudes and behaviors of friends and participants have stronger associations with youth drug use than the attitudes of family members and other adults. This departs from a majority of the literature cited above which shows significant parental and family influence on youth drug use [7, 26, 38]. It however aligns with an evaluation study which shows prevention intervention impacting peer/individual domains but not the family domain [25]. In addition, the higher frequency of factors related to marijuana in models is consistent with reported national youth drug behavior which shows that marijuana and prescription drugs are most commonly used among youths and are gateway drugs to other substances [20]). However, the relative strength of association with youth drug use among factors related to LSD, cocaine, meth, and other drugs; and beer, liquor, and wine when compared to factors related to cigarettes, is inconsistent with reported national youth drug use patterns mentioned above [20]).

The data patterns in this study align with the assumptions and explanations offered in the conceptual framework. SCT within its reciprocal determinism construct recognizes interactions between youth drug use behavior and personal factors such as youth attitudes, perceptions, and behavior; (micro)environmental factors including attitudes, perceptions, and behavior of best friends, family, and adults; and socio-cultural factors such as ease of access to drugs are associated with youth drug use. In addition, SCT anticipates the role of negative or positive reinforcements from the micro-environmental contexts in the process of building behavioral capability and self-efficacy [43, 44]. Variables related to friends and participants provide more negative or positive reinforcements to youth drug use behavior than variables related to parents and adults in participants' lives. In addition, drug and non-drug antisocial behavior of peers and participants seem to also represent stronger reinforcements to youth drug use behavior than prosocial behavior.

Study Limitations

Despite its many strengths, this study has a number of limitations. Since the study sample is drawn from eighth, tenth, and twelfth-grade students of PUSD which are predominantly made up of low-income, immigrant, and ethnic students, the generalizability of the results beyond PUSD ethnic or immigrant communities might be compromised. Furthermore, the study depends on self-report which has limitations such as participant subjectivity, limited options that might not be experienced by respondents, and selection of the most socially acceptable options, so-called social desirability bias. In addition, the study is observational (an experimental design is not possible). In any observational design, correlations do not necessarily imply causation. Like many observational studies, this study is also exploratory. While we controlled the false positive rate where feasible (e.g., for simple correlations and pairwise associations), this was not possible when implementing multiple regression models. Thus, false positive rates among those models may be slightly inflated. However, the potentially higher rate of false positives is to some extent mitigated by the observation of patterns across models (i.e., because certain predictors are included for many models, this enhances the evidence of their association with youth drug use). The results in

this study are generalizable to the Pomona community in particular, and potentially to other low-income, immigrant, and ethnic populations. Identified associations between predictor and outcome variables should not be interpreted as causation.

Conclusion and Implications for Community Practice

Conclusion

This study used Spearman's correlation and multiple regression analysis to identify associations between predictor variables in the micro-environment and youth drug use in the PYFMP follow-up data. Variables related to peers and friends showed greater strength of association to outcome variables than variables associated with parents and other adults in the participants' lives. Also, variables associated with participant antisocial behavior show a stronger association to youth drug use than variables associated with prosocial behavior. Furthermore, when multiple variables or factors are combined, they show greater strength of association to outcome variables than single variables or factors. The high number of times several predictor factors and variables appear in many models supports the reliability of the models' ability to predict outcome variables. Also, the consistency of findings between Spearman's correlation and multiple regression analysis underscores the reliability of the methods and findings in this study.

Some of the patterns in this data such as the diminished influence of parents and adults on youth drug use behavior are unique to Pomona and chart a path to unique additional studies and unique youth drug use behavior intervention designs. The unique findings in this study underscore the need for small-area analysis in community health practice and the need for low-income, immigrant, and ethnic communities to develop their own community data when designing youth drug use prevention programs.

Recommendations

The distribution and concentration of predictor variables and factors in the different regression models have practical significance such as guiding the design of future youth drug use prevention interventions as described in this paragraph and expanded in the paragraphs that follow. Future interventions should consider prioritizing strategies targeting participants and their friends over parental and adult factors and prioritizing antisocial behavior strategies over prosocial behavior. In the long run, additional research should be done to understand the diminished role of parents in youth drug behavior and to use the findings in developing tools to help parents engage with their children.

Variables and factors related to friends and participants exhibit a relatively stronger association to youth drug behavior models than factors related to parents and adults in the youths' lives. For future youth drug use intervention programs in Pomona, we suggest the prioritization of intervention activities targeting factors associated with participants' best friends and participants themselves to those targeting adults and parents.

Both drug and non-drug antisocial behaviors show a relatively stronger association with youth drug use behavior than prosocial behavior. In this vein, when targeting participants, factors associated with youth antisocial behavior should be prioritized in intervention activities over factors associated with prosocial behavior.

Given the relatively stronger predictive power of models with higher concentrations of a diverse range of predictor variables and factors, we suggest that after prioritizing individual youth, peers, and antisocial factors as recommended above, youth drug use prevention program implementers should prioritize predictor variables which target as many predictor variables and factors as possible. If implementing community-wide interventions, implementers should consider those intervention activities that might be associated with as many predictor variables and factors as possible.

The relatively stronger relationship between youth drug use and factors related to friends and participants when compared to parents and adults suggests a troubling reduced role for parents and adults when it comes to influencing youth drug use in Pomona in comparison to other communities documented in the literature. We recommend that in the short-term Pomona program, implementers should focus on additional studies on the potential impact of immigrants, low income, and ethnic status on parental and adult influence in youth drug use in Pomona. The long-term focus should utilize the findings from the studies recommended above to help parents and adults engage more with youths in the Pomona community.

The recommendations above could be taken up by three lead agencies in the PYFMP: Pomona School District Pupil and Community Services Department, the City of Pomona Neighborhood Services Department, and the Pomona Valley Youth and Family Club which is an outgrowth of the Pomona Boys and Girls Club. This should be in collaboration with institutions of higher learning, community-based organizations, faith-based organizations, businesses, etc. These recommendations will be submitted to the City of Pomona, the Pomona Unified School District, and the Pomona Youth and Family Club.

Author Contribution All authors contributed to the data analysis, literature review, and revision of different versions of the paper. The lead author was responsible for the conceptualization of the paper and participated in the data collection in partnership with industry consultants and members of the Pomona Youth and Family Master Plan.

Data Availability The data used is not publicly available. It could be shared with appropriate requests and specified conditions.

Code Availability The codes would also be available after appropriate requests. The codes are publicly available.

Declarations

Ethics Approval This study was approved by the Institutional Review Board of Jackson State University, Mississippi in 2014 as an exempt study #01–31-2014 and the Institutional Review Board of Charles R. Drew University, Los Angeles in 2007 as an expedited study #07–02-003–01.

Consent to Participate The parents of participants gave their consents and the youth voluntarily participated.

Consent for Publication Both the parents and School District and the Pomona Youth and Family Master Plan Advisory Board consented to the publication of the findings.

Conflict of Interest The authors declare no competing interests.

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