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Substance Use Initiation among Mexican Children: An Examination of Individual and Ecological Factors

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Substance Use Initiation among Mexican Children: An Examination of Individual and Ecological Factors

by

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ABSTRACT

Substance Use Initiation among Mexican Children: An Examination of Individual and Ecological Factors

by

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Early substance initiation is associated with negative outcomes across the lifespan and is known to impact social, academic, and interpersonal domains. Early identification and intervention may prevent the development of mental and physical health problems associated with early use. This is particularly relevant in context such as Mexico, where the demand for health services far exceed available resources. This three-manuscript dissertation sought to improve targeted prevention efforts through the exploration of individual and socioecological factors in their association with substance initiation among Mexican children. Data was drawn from a national prevention needs assessment survey conducted in Mexico. The first two manuscripts focused on examining child demographics and parental characteristics and practices in their association with substance initiation and intentions for first time use. The third manuscript utilized machine learning to assist in the identification of high value predictors of substance use across a broad range of child individual and socioecological factors. Findings from this research highlight potentially fruitful avenues for future research and could inform ongoing substance use prevention efforts in Mexico. Findings also suggest that machine learning may be a valuable tool for augmenting existing prevention programs through improved identification of at-risk children.

(144 pages)

PUBLIC ABSTRACT

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Alejandro L. Vázquez

Mexico is experiencing increased rates of substance use among children and adolescents. This is concerning as early substance use is associated with an increased risk for developing mental and physical health problems during adulthood. These outcomes may be prevented through early identification and intervention before individuals encounter the negative consequences of substance use/abuse. The current dissertation sought to improve our knowledge regarding factors associated with substance use and intention for first time use among Mexican children. Three manuscripts examined child individual characteristics and aspects of their environment. The first manuscript examined demographic characteristics to determine whether particular groups of children were at increased risk for substance use and intensions for first time use. We found that being a boy, of indigenous background, non-religious, and over developmental age for grade were all associated with risk. The second manuscript focuses on examining parent characteristics and practices on substance use and intention for first time use. We found that parental illicit substance use was associated with the largest increases in risk and positive parenting was a protective factor. The third manuscript utilized machine learning, an algorithmic approach that predicts membership in one of two groups, to assist in the identification of high value factors that distinguish between substance users and non-users. Findings from this research identified factors associated with childhood substance use at individual and environmental levels. Being a boy and having a best friend or father that used illicit substances were the key indicators that could provide valuable information as screening questions. These findings provide valuable information needed to inform the development of early substance use prevention programs in Mexico. Results also suggest that machine learning may be an important tool in uncovering information that could bolster prevention efforts by improving our ability to identify children at risk for substance use. This research was supported by the Utah State University Psychology Department and School of Graduate Studies.

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Alejandro L. Vázquez

CONTENT

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

GENERAL INFORMATION

The earlier youth engage in substance use the greater chances of negative developmental trajectories (e.g., adulthood medical and psychological disorders; Wymbs et al., 2014). This is concerning as rates of substance use among children and adolescents have risen across the globe, prompting a need for greater investment in preventative efforts aiming to delay the onset of substance use (World Health Organization [WHO], 2017, 2018). Mexico is experiencing this trend, which may foreshadow a public health crisis as rates of substance use increase within the context of limited resources available to address substance use disorders (Borges et al., 2009; Villatoro Velázquez et al., 2016). One potential solution may be to utilize targeted prevention programs to equip children and families with the skills necessary to navigate common risk factors prior to developmental periods were youth engage in higher rates of substance use (i.e., roughly age 13 in Mexico; Villatoro Veláquez et al., 2016). However, studies in Mexico have predominantly focused on substance use after age 12, which has resulted in a dearth of knowledge regarding risk and protective factors for substance use prior to adolescence (Benjet et al., 2007; Villatoro Veláquez et al., 2013; Villatoro Veláquez et al., 2017). The current dissertation sought to address this gap in the literature by identifying individual and socioecological factors associated with substance initiation among Mexican children.

Individual Influences

Previous research has documented the impact of demographic factors such as age (Villatoro Veláquez et al., 2016), gender (Evans-Polce, Vasilenko, & Lanza, 2015), socioeconomic status (Ortiz-Hernandez, Lopez-Moreno, & Borges 2007), developmental

age relative to grade level (Dudovitz et al., 2015) and religiosity (Benjet et al., 2007) on adolescent risk for substance use. Child ethnic group membership may also impact risk for substance use. Mexico has a significant indigenous population (i.e., 10 million) that experience risk factors (e.g., marginalization, low income, poor education, lack access to public services; UNICEF, 2011) associated with substance use among Native Americans youth in the US (Nails, Mullis, & Mullis, 2009). These findings suggest that a variety of demographic factors may influence substance use. However, studies have yet to determine whether these demographic factors associated with substance use generalize to Mexican children.

In addition to demographics, individual factors such as self-esteem (Zamboanga, Schwartz, Jarvis, & Van Tyne, 2009), sensation seeking (Robbins & Bryan, 2004), future aspirations (Darling, 2005), school engagement (Marsiglia, Miles, Dustman, & Sills, 2002), and perception of risk (Johnston et al., 2018) have all been linked to substance use among adolescence. However, studies have yet to examine the relative importance of these factors in predicting group membership for substance use outcomes among Mexican children (i.e., lifetime substance user or non-user).

Neighborhood Quality, Community, and Peer Influences

Children living in high poverty neighborhood may be at greater risk for engaging in substance use. Findings from the US suggest that living in unsafe neighborhoods is associated with higher rates of adolescent substance use (Andreas & Watson, 2016). Youth residing in urban communities appear to also exhibit higher rate of tobacco and illegal substance use relative to their rural counterparts (Villatoro-Velazquez et al., 2016). Adolescent in high risk communities may have greater contact with deviant peers that

may facilitate access to and use of substances (Gilliard-Matthews et al., 2015; Hussong, 2002; Kliewer et al., 2007). These findings suggest that aspects of the environment may influence youth's opportunities and decisions to engage in substance use. Further research is needed to determine whether these ecological factors may generalize to substance use among Mexican children.

Parental Influences

Parents are children's best teachers. WHO (2018) has identified aspects of parental monitoring and involvement as important factors in delaying the onset of substance use among adolescents. In contract, parental behaviors such as substance use may increase adolescent risk for substance use (Li, Pentz, & Chou, 2002). Previous research has also found that parent-child communication can negatively impact adolescent alcohol and tobacco use (Luk, Farhat, Iannotti, & Simons-Morton, 2010). However, findings within the context of the US suggest that parent-child communication is not associated with a reduction in substance use among adolescents (Ennett et al., 2001). These findings suggest that parenting characteristics may both contribute to the promotion or prevention of substance use among children. Yet, further research is needed to determine whether substance use communication may be more effective during childhood when parental influences may be stronger than that of peers (Cleveland et al., 2008).

Aims

The current dissertation sought to inform childhood prevention efforts by increasing the knowledgebase regarding risk and protective factors associated with substance initiation among Mexican children. Our aims were to (a) identify demographic

factors associated with lifetime substance initiation and intentions for first time use, (b) examine the potential association between parenting characteristics and childhood substance intentions and use, and (c) to maximize discriminatory predict of lifetime substance use utilizing machine learning. These research questions were explored in depth across three manuscripts. Additional information regarding hypothesis, methods, results, and discussion can be found in the individual manuscripts.

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CHAPTER II

DEMOGRAPHIC CHARATERISTICS THAT PREDICT SUBSTANCE USE

The following chapter is a pre-printed version of an accepted manuscript titled, *Early Adolescent Substance Use in a National Sample of Mexican Youths: Demographics Characteristics that Predict Use of Alcohol, Tobacco, and Other Drugs*. The authors were Alejandro L. Vázquez, Melanie M. Domenech Rodríguez, Sarah Schwartz, Nancy G. Amador Buenabad, Marycarmen N. Bustos Gamiño, María de Lourdes Gutierrez López, and Jorge A. Villatoro Velázquez. This manuscript was accepted for publication in the *Journal of Latinx Psychology* in January, 2019. The pre-print follows the journal publication format requirements. The published article can be found at the following link: https://doi.org/10.1037/lat0000128

Early Adolescent Substance Use in a National Sample of Mexican Youths: Demographics Characteristics that Predict Use of Alcohol, Tobacco, and Other Drugs

The US and Mexico have seen significant increase in the prevalence of substance use among Latinx adolescents in the last 20 years (Johnston et al., 2018; Villatoro Velázquez et al., 2016), in addition to increased rates of substance use in cities along Mexico's northern border with the US (Becerra & Castillo, 2011). Latinx youth may be especially vulnerable to the negative consequences of substance use due to greater cultural acceptability of use (i.e., alcohol; Parsai, Voisine, Marsiglia, Kulis, & Nieri, 2009), and limited access to intervention programs in both the US and Mexico (Borges et al., 2009; Saloner & Cook, 2013). Research in the US has documented the negative impact of substance use prior to the age of 13, which is associated with an increased risk for school avoidance, fighting, and substance dependence (King & Chassin, 2007; Sales-

Wright, Hernandez, Maynard, Saltzman, & Vaughn, 2014). Furthermore, US-based researchers have found that the consequences of adolescent substance use can persist into adulthood, contributing to the development of mental and medical health disorders (10.1% Latinx; Wymbs et al., 2014). Despite the negative impact of early substance use, much of the current literature between the US and Mexico has focused predominantly on middle to late adolescence (i.e., ages 12-18; Benjet et al., 2007; Johnston et al., 2018; Villatoro Veláquez et al., 2013; Villatoro Veláquez et al., 2017), suggesting a potential dearth of knowledge on factors that predict substance use in the preadolescent period. Identifying factors associated with the emergence of substance use during the years leading into adolescence may provide valuable information needed to aid the development of prevention programs targeting Latinx youth. This knowledge may be useful for prevention efforts in Mexico and in contexts like the US, where there are a sizeable number of Latinx immigrants.

Previous research in the US suggests that Latinx boys are at greater risk for alcohol, tobacco, and marijuana use relative to girls during adolescence and early adulthood (Evans-Polce, Vasilenko, & Lanza, 2015). Findings among adult populations in Mexico suggest that men between 18 and 34 years of age report the highest percentages of consumption of illicit drugs (Villatoro Veláquez et al., 2013). US-based researchers have posited that elevated rates of substance use among Latinx boys and men may be explained by greater cultural acceptability of alcohol use among boys relative to girls (Parsai et al., 2009) and alignment with a cultural value of *machismo* that may contribute to a greater likelihood of substance initiation and use (Unger et al., 2002). Thus, it is possible that cultural risk factors (e.g., acceptability of alcohol use, machismo)

among Latinx boys may contribute to an elevated risk for substance use that may persist into adulthood. Yet, further inquiry is needed to determine if this gender-based difference in risk for substance use is present among elementary age Latinx youth.

In the US, increases in age are associated with increases in risk for substance use across genders (Aspy, Tolma, Oma, & Vesely, 2014). In Mexico, the age of initiation for alcohol and tobacco use is approximately 13 years-old for both boys and girls (Villatoro Veláquez et al., 2016), with the risk for substance use increasing significantly after age 15 (Benjet et al., 2007). These finds are consistent with prior research that has observed a rapid escalation in rates of substance use from childhood to adolescence among Mexican-origin youth in the US (Atherton, Conger, Ferrer, & Robins, 2015). In Mexico, this trend is reflected in significant increases in the rates of substance use from middle school (i.e., 24.2%) to high school (i.e., 54.3%; Villatoro Veláquez et al., 2016). Researchers in the US have also noted the impact of age and grade on substance initiation. Dudovitz and colleagues (2015) examined higher rates of risky behavior among youth above the developmentally appropriate age for their grade. Their findings suggest that pubertal stage may explain increases in risk for substance initiation among overage youth (i.e., youth above the typical age for their grade), which may be attributed to increases in sensation seeking associated with advanced pubertal stage. Given that risk for substance use initiation escalates with each subsequent developmental stage, there is a need to identify risk factors implicated in substance use during earlier developmental periods (i.e., early adolescence, prior to age 12), in addition to factors that promote positive developmental trajectories.

Substance use may vary depending on substance and socioeconomic status (SES). Ortiz-Hernandez, Lopez-Moreno, and Borges (2007) found that patterns of substance use varied across SES in Latin American countries. High SES adolescent were more likely to engage in alcohol use, smoking, and prescription drug use relative to low SES youth. In contrast, adolescents with low SES were more likely to develop mental health problems and alcohol abuse/dependence relative to high SES youth. Thus, while high SES youth may have greater prevalence of substance use, low SES Latinx youth may be especially vulnerable to the detrimental effects of substance use. Adolescents perceptions of SES may also impact their risk for substance use. Previous research in Mexico suggests that high perceived socioeconomic status among youth was associated with greater risk for initiating in substance use (Ritterman et al., 2009). Thus, it is possible that SES and adolescents' perceptions of their economic status may impact substance use during early adolescence.

Rates of substance use may be impacted by the type of communities youth reside in. In a sample of Mexican students (i.e., 5th and 6th grade, middle school, high school), the prevalence of alcohol consumption among youth did not significantly differ between urban (i.e., 17.1%) and rural (i.e., 16.1%) communities (Villatoro Veláquez et al., 2016). However, urban youth experienced significantly greater prevalence of tobacco and illegal substance use relative to rural youth. Therefore, characteristics of the adolescent's community may increase their risk for utilizing different substances. These findings suggest a need to further examine whether community status predicts early adolescent substance use across a broad range of substance (i.e., alcohol, tobacco, marijuana, inhalants, other drugs).

Another potential factor impacting substance initiation and use among Latinx adolescents is religiosity. Greater religiosity among Central American (i.e., Panamá, Costa Rica, Guatemala) youths and their parents may contribute to a reduced risk for lifetime substance use and dependence (Kliewer & Murrelle, 2007). These findings appear to be consistent across context as religiosity is associated with a reduced risk for adolescent substance use among Latinx youth residing in the US and Mexico (Benjet et al., 2007; Hodge, Marsiglia, & Nieri, 2011). Researchers in the US have documented that spirituality may increase abstinence from marijuana and hard substances (84% Latinx; Hodge, Cadenas, & Montoya, 2001), and can act as a buffer against the negative impact of life stressors that may promote substance initiation (3% Latinx; Wills, Yaeger, & Sandy, 2003). No known research has extended these findings to earlier developmental stages.

Many Mexican youths belong to indigenous ethnic groups. The United Nations Children's Fund (UNICEF; 2011) estimates that 9.8% (i.e., 10 million) of Mexico's population belong to an indigenous ethnic group. Indigenous Mexicans experience marginalization, low income, poor education, and limited access to public services at disproportionate rates. This is of concern since exposure to poverty and community-based stressors (i.e., disadvantaged neighborhoods, crime, sale of drugs) are associated with the development of mental illness (i.e., depressive disorder) and substance use initiation among native populations in the US (Nails, Mullis, & Mullis, 2009). Given that Mexican indigenous youth experience high rates of social (i.e., marginalization, poor education) and community (i.e., poverty, limited access to services) stressors, further research is

needed to determine whether indigenous heritage in Mexico represents a risk factor for substance use.

The current study examined demographic predictors of substance initiation and use among 5th and 6th graders who participated in a national survey on substance use in Mexico. Our primary aim was to identify demographic factors that may contribute to an increased risk for substance initiation and use within a large sample of elementary age Latinx youth. Based on previous research, we hypothesized that factors such as being a boy, of indigenous heritage, low religiosity, and high perceived economic status would be associated with an elevated risk for reported lifetime substance intent and use in our sample. Furthermore, we expected that 6th graders would be more likely to engage in substance use, while 5th graders would be more likely to report intent to use substances for the first time. Youth that were above the developmentally appropriate age for their grade (i.e., 5th = ages 10-11 and 6th = ages 11-12), were expected to be more likely to report lifetime substance use relative to their age appropriate peers. Finally, youth residing in urban communities were expected to be at greater risk for tobacco and illegal substance use, while alcohol use was not expected to differ across community types.

Method

The present study drew from the National Survey of Drug Use Among Students (Encuesta Nacional de Consumo de Drogas en Estudiantes; ENCODE), a national survey on substance use that included 191,880 elementary, middle, and high school students. Data for the present study included 52,171 elementary students (5th and 6th grade) that participated in the ENCODE survey. Self-report data on adolescents included: Age (M_{age} = 10.40; SD_{age} = .82), gender (26,477; 50.8% boys), grade (31,219; 59.8% 5th),

indigenous heritage (7,682; 14.7%), and the type of community that they resided in (36,401; 69.8% urban). Of the participants included in the current study, 1,488 (2.9%) adolescents were above the typical age for their grade. Additionally, 46,583 (89.3%) participants reported that religion was important to them. Students qualified for the study if they were enrolled in a selected school and were present during the period the survey was administered. The non-response rate was 18.4% within the elementary school sample, primarily due to absences.

Procedures

The present study used extant data. ENCODE representatives were granted permission by the Secretary of Public Education in Mexico to survey students and train school staff in the administration of the national survey on substance use. Parents did not provide active consent as the Secretary of Public Education granted the consent; students provided assent at the outset of the survey and students that did not wish to participate could elect to do so. Approval was sought for the current study from the Institutional Review Board and the Ethics Committee of the [masked for peer review]. ENCODE collected data utilizing a cross-sectional design. The original sample was gathered using a stratified sampling approach so that each of the 32 states of the nation and each educational level (elementary, middle, and high school) within each state were sufficiently represented in the final sample, specifically, there were 1,560 students per each educational level within each state. Within this strategy, schools were randomly selected for participation in the national survey. Participants completed paper surveys in a 70 min group session. Survey questions were read out loud to the elementary age students in their classrooms to reduce developmental language barriers. The ENCODE team

conducted validity checks (e.g., zig zags, inconsistent responses between lifetime and 30-day use) of outcome variables (i.e., lifetime use and intentions) and removed inconsistent responders (n = 476; 0.009%) from the original sample (n = 52,647). The current study confirmed the validity of lifetime use and intention outcomes by examining response consistency across a variety of indicators (e.g., last year, 30 days use, lifetime use for first time substance intentions). Responses were consistent for all outcomes with the exception of other substance use intentions. Inconsistent responders were removed from analysis examining other substance use intentions (n = 1,450, 2.8%). Detailed methodological information is found in Villatoro Veláquez et al. (2016).

Measures

Youth characteristics. Youth self-reported data on individual items for age, gender, and grade. An "overage" variable was generated to represent participants who were above the typical age for their respective school grades (i.e., 5^{th} = ages 10-11 and 6^{th} = ages 11-12; Dudovitz et al., 2015).

Ethnicity. Previous research has utilized household language as a proxy for measuring acculturation and ethnicity among Latinx populations (Wallace, Pomery, Latimer, Martinez, & Salovey, 2010)**.** Within the current study, participants were queried regarding their indigenous heritage with a single item ("Of the people that live in your home does anyone speak an indigenous language?"). Youth responded *yes* (1) or *no* (0).

Substance intent and use. Participants were asked to report on lifetime substance use on five items that queried alcohol, tobacco, marijuana, inhalant, and other substance use individually. Participants indicated whether they had past use, *yes* (1) or *no* (0), for each substance. Intention to use substances was measured using substance specific items.

Participants who had not previously initiated in substances use were asked to rate the likelihood that they would engage in alcohol, tobacco, or other substances use (e.g., marijuana, inhalants) on a 4-point scale: *not likely* (1), *likely* (2), *very likely* (3), *I already consume alcohol* (4). A dichotomous substance use intentions variable was created by coding responses for those who reported that they were *"likely"* or *"very likely"* to use substances as *probable* (1), while those who reported that it was "*not likely"* were coded as *not probable* (0).

Subjective economic status. A scale was created by the ENCODE team to assess youth's perceived economic status. This measure consisted of 11-items asking participants to endorse whether they had access to basic necessities (e.g., buying food, clothes, parents ability to pay bills). Responses were in the form of a 3-point scale: *always* (1), *sometimes* (2), and *never* (3). Items were averaged with higher scores reflecting greater perceived economic status. The scale had good internal consistency within the current sample ($\alpha = .855$).

Community. Participants reported on the type of community they resided in across five categories: *large urban area or city* (1), *medium city* (2), *small city* (3), *village* (4), *ranch* (5). Responses were recoded into dichotomous categories: *urban* (1) and *agricultural* (0). Large urban area, medium, and small cities were coded as *urban*.

Religiosity. Participants reported on how important religion was to them on a single item with a 3-point scale: *not important* (1), *somewhat important* (2), *very important* (3). Youths who reported that religion was somewhat or very important were coded as being *religious* (0), otherwise they were considered *nonreligious* (1).

Data Analysis

In the overall dataset, 11,697 participants were missing at least one covariate. Chi-square tests of independence were used to determine whether there was a relationship between incomplete (i.e., missing at least one variable) and complete cases for each variable (e.g., grade, gender, subjective economic status items). Results showed statistically significant relationships between observed and missing cases for all variables ($p < .001$). When observed values for variables are related to missing values they are said to be missing conditionally on other variables (Enders, 2010). As patterns of missingness were related to observed cases for all variables, multiple imputations can be used to estimate missing values based on information provided by observed values (Donders, van der Heijden, Stijnen, & Moons). Analysis was conducted in two steps using SPPS. First, in the imputation stage, five datasets were created with missing responses filled differently with generated values in each dataset. Items were imputed individually, as this method improves estimate accuracy when missingness exceeds 10% (Eekhout et al., 2014). Second, in the analysis stage, binary logistic regression analyses were conducted independently in each of the five datasets and results were pooled to examine predictors of substance intent and use. Results are interpreted in the same manner as standard logistic regression.

Results

Within the current sample, lifetime alcohol use was the most frequently endorsed substance (n = 8,954; 17.2%), followed by tobacco (n = 3,626; 7%), marijuana (n = 1,435; 2.8%), inhalants (n = 1,130; 1.9%), and other substances (e.g., cocaine, methamphetamine; n = 1,002; 1.6%). Among youth who denied lifetime substance use,

rates of intentions to engage in future use were highest for tobacco (n = 5,369; 10.3%) and other substances (3,094; 6.1%), followed by alcohol (2,841; 5.4%).

Substance Use

Alcohol. Most demographic variables yielded statistically significant differences between comparison groups suggesting they were predictors of elevated risk for alcohol use (see Table 1 for model statistics, odds ratios [OR], and 95% confidence intervals [CI]). Boys were more than twice as likely to report trying alcohol during their lifetime relative to girls. Youths in the 6th grade were more likely to endorse alcohol use relative to their 5th grade peers. Youth who were overage for their grade were more likely to report alcohol use relative to those who were the appropriate developmental age. Indigenous youth were more likely to use alcohol than their non-indigenous peers. Youths who reported that religion was not important to them were also more likely to use alcohol relative to those who endorsed religion as being important. Subjective economic status and community type were not related to adolescent report of alcohol use.

Tobacco. Boys were two times and a third more likely to report tobacco use relative to girls (see Table 1). Furthermore, 6th graders were more likely than 5th graders to report trying tobacco. Individuals who were overage for their grade were two and half times more likely than their age appropriate peers to report that they had used tobacco. Indigenous youth were also more likely to report use as compared to non-indigenous youth. Religious youth were less likely to report tobacco use relative to their non-religious peers. Of the lifetime substance use indicators examined, tobacco use was the only substance associated with subjective economic status. Unit increases in subjective economic status were associated with reductions in risk for reporting lifetime tobacco

use. Community type was not significantly associated with adolescent report of tobacco use.

Marijuana. Marijuana had the largest gender difference in odds of use. Boys were nearly three times more likely than girls to report using marijuana (see Table 1). Unlike alcohol and tobacco, participants in the 5th grade were more likely to report use relative to 6th graders. Yet overage students were twice as likely to report use relative to their age appropriate peers. Non-indigenous youth were less likely than indigenous youth to report use. Lastly, non-religious youth were twice as likely to use marijuana relative to religious youth. Community type and subjective economic status were not significantly related to lifetime marijuana use.

Inhalants. Inhalant use was nearly three times more likely among boys relative to girls (see Table 1). Fifth graders were at greater risk for use relative 6th graders. Overage youth were two times more likely to report inhalant use relative to their age appropriate peers. Indigenous youth were more likely to report use relative to non-indigenous youth. Non-religious youth were twice as likely to report use as compare to their religious peers. Community type and subjective economic status were not related to reported use of inhalants.

Other substances. Use of other substances was higher among boys, such that girls were nearly three times less likely to report use (see Table 1). Participants in the 5th grade were more likely to report other substance use relative to 6th graders. Overage youths were especially at risk with nearly three times greater likelihood of use than their age appropriate peers. Indigenous heritage was associated with a greater likelihood of use as compared to non-indigenous youth. Residing in an urban community was associated

with greater risk for reporting trying other substances. Lastly, non-religious youth were two times more likely to report use relative to their religious peers. Subjective economic status was not related to lifetime use of other substances.

Substance Initiation

Alcohol. Intention to initiate in alcohol differed between gender. Specifically, boys who had not previously tried alcohol were more likely to report that they would "probably" initiate in alcohol use relative to girls (see Table 2 for model statistics, odds ratios [Ors], and 95% confidence intervals [Cis]). Unit increases in subjective economic status were associated with a reduced likelihood of reporting alcohol intentions. Indigenous youth were more likely to report alcohol intentions relative to their non-indigenous peers. Overage, community, grade, and religiosity were not related to intentions to initiate in alcohol use.

Tobacco. Adolescent intentions to initiate in tobacco use were greater among boys (see Table 2). Youth in the 5th grade were more likely than 6th graders to report that they would initiate tobacco use. Unit increases in subjective economic status were associated with reduced odds of reporting tobacco intentions. Moreover, indigenous youth were more likely to report that they would try tobacco as compared to non-indigenous youth. Adolescent community, overage, and religiosity were not associated with intent to initiate tobacco use.

Other substances. Boys were more likely to report intent to use other substances relative to girls (e.g., cocaine, methamphetamine; see Table 2). Intentions to initiate in other substance use were more likely among 5th graders. Furthermore, unit increases in adolescent subjective economic status were associated with a lower likelihood of

intentions to initiate in use. Indigenous youth were more likely to report that they would initiate in use relative to non-indigenous youth. Community type, being overage, and religiosity were not related to adolescent intentions to initiate in other substances use.

Discussion

The current study extends previous literature by identifying demographic factors implicated in substance use and intentions in a nationally representative sample of Mexican youth. Little research has addressed youths at this pre-adolescent developmental level and the data may be very useful in informing prevention programming for countries with sizeable Latinx populations. Some of our findings are powerful for their consistency. Boys, of indigenous heritage, and nonreligious youths were consistently at increased risk for intentions and use of all substance in relation to their comparison group. Consistent with previous research, gender was associated with greater probability of substance use, with boys being more likely to use all substances (i.e., alcohol, tobacco, marijuana, inhalants, other substances) relative to girls (Evans-Polce et al., 2015). It appears the paths that lead to differential risk across gender are established prior to 5th grade. It is possible that greater cultural acceptability and machismo values may contribute to higher rates of early alcohol use among Latinx boys (Parsai et al., 2009; Unger et al., 2002), which may contribute to initiation in other substance use (e.g., tobacco, marijuana, illicit substances; Kirby & Barry, 2012). Indigenous heritage youth in Mexico may face common risk factors associated with substance use (e.g., marginalization, disadvantaged neighborhood, crime, proximity to drugs; Nalls et al., 2009; UNICEF, 2011). It is possible that Mexican children with indigenous heritage may be more likely than non-indigenous youths to live in disadvantaged neighborhoods where they may be more likely

to encounter risk that increase the probability of substance use initiation (e.g., presence of deviant peers; Gilliard-Matthews, Stevens, Nilsen, & Dunaev, 2015; Kliewer & Murrelle, 2007). Findings also suggest that religiosity among Latinx youth may protect against the use of a variety of substances (i.e., alcohol, tobacco, marijuana, inhalants, and other substances; Benjet et al., 2007; Hodge et al., 2001).

Findings were less consistent for age, which appeared to differentially impact substance use among elementary age youth. In contrast to previous findings, younger students (i.e., 5th graders) were more likely to report engaging in illegal substance use (i.e., marijuana, inhalants and other substances), while their older peers (i.e., 6th graders) were more likely to report the use of legalized substances (i.e., alcohol and tobacco; Aspy et al., 2014). However, overage students may be at the greatest risk for substance use in general, potentially due to a rapid escalation of substance use associated advanced pubertal age, which may contribute to greater sensation seeking (Dubovitz et al., 2015). Consistent with previous findings, adolescents living in urban communities may be at an elevated risk for other substance use relative to youth in agricultural communities (Villatoro Veláquez et al., 2016). However, findings suggest that community status risk factors for alcohol, tobacco, marijuana, and inhalant use and intentions did not significantly differ among rural and urban Mexican youth during early adolescences. While higher SES youth may have greater financial resources to access substances (Andrabi et al., 2017), youth across economic levels were largely at equal risk for reporting lifetime alcohol, marijuana, inhalant, and other substance use during early adolescence. However, substance intentions and use may vary across economic levels for specific substances. Specifically, higher subjective economic status was associated with

lower odds of reporting lifetime tobacco use and intentions for engaging in first time use of a variety of substances (i.e., alcohol, tobacco, other substances). These findings suggest that youth with high subjective economic status may be at a reduced risk for use intentions relative to peers with lower economic status.

Implications

Findings of the current study indicate that elevated rates of substance use and associated risk factors are present at significant levels during early adolescences (i.e., M_{age} = 10.40). Prevention efforts may focus on developing early screening methods/procedures to identify high risk youth before patterns of substance use escalate. Demographic risk factors outlined in the current study may be of clinical utility for elementary school staff and mental health providers seeking to identify vulnerable Latinx youth in need of referral for preventative services in Mexico and in the US with Mexican-origin youth. Indigenous youth may be an especially vulnerable population needing further clinical and research attention to address elevated rates of perceived intent for and use of substances. It is critical that this information not be used to advance stereotypes about marginalized populations but rather to understand the needs of a particular group that likely experience these risks partly because of social processes, such as institutional racism, that have led to marginalization and have increased risk for negative outcomes. Recent manuscripts have pointed to the importance of attending to social justice when conducting research (Baumann et al., in press; Domenech Rodríguez et al., in press).

Accessible substance use prevention services are needed to encourage positive developmental trajectories among Latinx youth exposed to factors that contribute to elevated risk for substance initiation during early adolescence. Yet, obstacles to mental

health services persist in both the US and Mexico for Latinx populations, necessitating further efforts to disseminate substance use prevention/treatment programs and educational initiatives to inform the general public of the detrimental effects of substance use (Saloner & Cook, 2013; Borges et al., 2009). Additionally, efforts are needed to adapt evidence based interventions to work within Mexico's unique cultural and economic context to improve access to effective preventative services (Atilola et al., 2012).

Limitations

Despite the strengths of the current study, findings should be viewed within the context of several limitations. The large nationally representative Mexican sample was a strength of this study, yet findings may not generalize to Latinx youth living in the US or other countries. Furthermore, findings may not generalize to other age groups within Mexico.

The current study utilized child report of demographic and substance use factors. It is possible that students lacked accurate knowledge regarding their SES, and community status, which could affect the accuracy of their responses. It is also important to note that indigenous heritage was measured with a single variable utilizing spoken language at home as a proxy for ethnicity. Future research should utilize more comprehensive forms of measuring ethnicity to examine differences in risk for substance use between youth of indigenous and non-indigenous heritage.

While questions were read out loud to students to ensure comprehension, it is possible that students did not accurately understand what was being asked. Researchers might attempt to seek multiple sources of information including parent and teacher report of early adolescent substance use in future research. Relatedly, the examination of age-

related risk within the current study was limited to differences between 5th and 6th grade, which may represent small developmental differences. Thus, interpretation of these findings is cautioned as findings may not represent developmental risk trajectories given the restricted age range. Research is needed to examining the impact of substance use initiation among elementary youth on developmental trajectories. Further research is also needed to identify individual, contextual, familial, and social risk factors to better understand the nature of early adolescent substance use among Latinx youth.

Conclusions

Findings of the current study suggest that elevated rates of alcohol and tobacco use are present during early adolescence. Latinx youth who were boys, of indigenous heritage, nonreligious, and overage for their grade were especially at risk for alcohol, tobacco, marijuana, inhalant, and other substance use. Mental health researchers and policy makers in both the US and Mexico should consider prioritizing the development and dissemination of evidence-based programs to target early substance use to promote positive developmental trajectories among Latinx youth. Thus, further research is needed to examining factors implicated in early adolescent substance use among Latinx youth to inform the development of policies and intervention programs to address rising national rates of substances use. Additional research is also needed to determine whether demographic risk factors differ between Latinx youth residing in the US and Mexico.

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Table 1

*Demographic Predictors of Lifetime Substance Use from Aggregated Logistic Regression Analysis on Multiple Imputations Datasets (*N = *52,171)*

	Alcohol OR [95% CI]	Tobacco OR [95% CI]	Marijuana OR [95% CI]	Inhalants OR [95% CI]	Other[a] OR [95% CI]
Boys[1]	**2.05*** [1.96-2.15]	**2.36*** [2.19-2.54]	**2.89*** [2.56-3.26]	**2.70*** [2.36-3.09]	**2.72*** [2.35-3.13]
6th Grade[2]	**1.19*** [1.13-1.24]	**1.16*** [1.08-1.24]	**.85*** [.76-.94]	**.74*** [.65-.84]	**.81*** [.71-.93]
Overage[3]	**1.62*** [1.43-1.82]	**2.57*** [2.23-2.96]	**2.36*** [1.91-2.91]	**2.28*** [1.80-2.89]	**2.76*** [2.19-3.48]
Subjective SES[4]	1.05 [.98-1.12]	**.89*** [.81-.98]	1.02 [.88-1.19]	.98 [.82-1.16]	.97 [.81-1.16]
Indigenous[5]	**1.26*** [1.19-1.34]	**1.44*** [1.32-1.58]	**1.78*** [1.55, 2.04]	**1.77*** [1.52-2.05]	**1.79*** [1.54-2.10]
Urban community[6]	.98 [.93-1.03]	1.00 [.92-1.08]	1.13 [1.00-1.29]	1.08 [.93-1.24]	**1.23*** [1.06-1.44]
Non-religious[7]	**1.49*** [1.38-1.62]	**1.58*** [1.40-1.78]	**2.23*** [1.88-2.66]	**2.13*** [1.76-2.58]	**2.06*** [1.69-2.51]

Note: OR = odds ratio; 95% CI = 95% confidence interval. Table presents pooled results from five analyses performed on the five multiply imputated datasets. [a]includes substances such as cocaine, methamphetamine, etc. [1]relative to girls, [2]relative to 5th graders, [3]relative to appropriate age for grade, [4]relative to high perceived income, [5]relative to non-indigenous, [6]relative to agricultural communities[7]relative religious. *p < .05.

Table 2

Demographic Predictors of Perception of Intent to Initiate in Substance Use from Aggregated Logistic Regression Analysis on Multiple Imputations Datasets

	Alcohol (n = 23,008) OR [95% CI]	Tobacco (n = 45,287) OR [95% CI]	Other[a] (n = 43,515) OR [95% CI]
Boys[1]	**1.14*** [1.05-1.23]	**1.37*** [1.30-1.46]	**1.24*** [1.15-1.33]
6th Grade[2]	.94 [.87-1.02]	**.90*** [.85-.96]	**.82*** [.76-.89]
Overage[3]	1.03 [.80-1.32]	1.07 [.90-1.27]	1.17 [.95-1.44]
Subjective SES[4]	**.72*** [.64-.81]	**.68*** [.63-.74]	**.62*** [.56-.69]
Indigenous[5]	**1.13*** [1.01-1.26]	**1.30*** [1.21-1.40]	**1.28*** [1.16-1.42]
Urban community[6]	1.02 [.93-1.11]	.96 [.90-1.02]	.92 [.85-.99]
Non-religious[7]	1.15 [.98-1.36]	1.11 [.99-1.25]	1.15 [.99-1.34]

Note: OR = odds ratio; 95% CI = 95% confidence interval. Table presents pooled results from five analyses performed on the five multiply imputated datasets. [a]includes substances such as marijuana, inhalants, cocaine, etc. [1]relative to girls, [2]relative to 5th graders, [3]relative to appropriate age for grade, [4]relative to unit increase in subjective SES, [5]relative to non-indigenous, [6]relative to agricultural communities, [7]relative religious. *p < .05.

CHAPTER III

PERCIEVED PARENTING AND SUBSTANCE INITIATION

The following chapter is a pre-printed version of an accepted manuscript titled, The Influence of Perceived Parenting on Substance Initiation among Mexican Children. The authors were Alejandro L. Vázquez, Melanie M. Domenech Rodríguez, Sarah Schwartz, Nancy G. Amador Buenabad, Marycarmen N. Bustos Gamiño, María de Lourdes Gutierrez López, and Jorge A. Villatoro Velázquez. This manuscript was accepted for publication in *Addictive Behaviors* on October, 2019. The pre-print follows the journal publication format requirements. The published article can be found at the following link: https://doi.org/10.1016/j.addbeh.2019.05.026

The Influence of Perceived Parenting on Substance Initiation among Mexican Children

1. Introduction

Parents have the ability to shape child outcomes, especially in early childhood. Substance use initiation and maintenance are risk factors for negative outcomes for children (King & Chassin, 2007). The younger children are when they initiate substance use, the more marked the negative outcomes (Atherton, Conger, Ferrer, & Robins, 2015; Paiva, Amoyal, Johnson, & Prochaska, 2014). Negative outcomes span social, academic, and interpersonal domains and also represent a high cost to society in the long-term (Atherton et al., 2015; Paiva et al., 2014). The present manuscript seeks to uncover important parenting factors that may be amenable to intervention at a critical developmental juncture (i.e., 5th, 6th grade). Understanding the relevance of family factors in children's substance use initiation intentions and behaviors can help program developers prioritize prevention and early intervention program content. The current

study examined data from a national school-based survey in Mexico, providing an important reference point for researchers to understand the generalizability of established findings, potentially informing efforts in the United States with Mexican born families, and consider the impact of culture and context in parents' influence on the development of childhood substance use.

1.1. Childhood substance use

Rates of lifetime substance use among Latinx children in Mexico are on the rise (Villatoro Velazquez et al., 2016). The prevalence of lifetime substance use among elementary age children (i.e., 5th, 6th) in Mexico is 16.9% for alcohol, 6.5% for tobacco, and 3.3% for illicit substances (Villatoro Velazquez et al., 2016). While rates of substance use are expected to increase with age (i.e., ages 10-16; Atherton et al., 2016), prevalence rates of lifetime alcohol and tobacco use among Mexican children have surpassed that of adolescents (i.e., ages 12-17; 9.2% use alcohol, 5.3% use tobacco) in the United States (SAMHSA, 2017). Latinx boys appear to most at risk for early substance use, as they report higher rates of alcohol, tobacco, and marijuana use relative to girls (Evans-Polce, Vasilenko, & Lanza, 2015), which may be due to greater social acceptability of using particular substances by Latinx boys (Parsai, Voisine, Marsiglia, Kulis, & Nieri, 2009). Recent findings also suggest that Latinx children above the developmentally appropriate age for their grade may be especially at risk for substance use (Vázquez et al., 2019). Thus, it is important to examining the impact of demographic characteristics when examining contextual factors associated with early substance initiation.

1.2. Parenting practices

A broad variety of parenting practices are implicated in child outcomes. Using the framework of social interaction learning theory (Patterson, 2016), important parenting variables are: skills building, positive involvement, monitoring/supervision, effective discipline and problem solving. These parenting practices have been researched for decades in the context of delivering effective evidence-based interventions (Forgatch & Domenech Rodríguez, 2016; Patterson, 2016). Five decades of intervention have shown that improving these five parenting practices lead to increases in positive parenting and decreases in negative child behavior including substance use and substance initiation precursors (Patterson, 2016). More importantly, research has been conducted in Mexico using this conceptualization of parenting and a careful cultural adaptation process (Amador, Villatoro, Guillén, & Santamaría, 2019; Baumann et al., 2014). This intervention research has been carried out in Mexico City using rigorous randomized controlled trials and has shown the relevance of these parenting practices in child and parent outcomes (Amador et al., 2019).

Of the five parenting practices, research has documented most impact for parental monitoring on substance use specifically. Parental monitoring is associated with a decrease in substance use and delinquency during adolescence (i.e., peers, whereabouts, social plans; Atherton et al., 2015). Parental monitoring appears to moderate the relationship between environmental risk factors (i.e., peer substance use norms) and substance use among Mexican adolescents (Becerra, Castillo, Ayón, & Blanchard, 2014). However, parental monitoring's impact on substance use appears to vary by substance type among elementary age Latinx children in the United States. Yabiku and colleagues (2010), conducted a longitudinal examination of the impact of parental monitoring on

substance use and use intentions among 5th graders of mostly Latinx origin. They found that parental monitoring impacted alcohol and tobacco but not marijuana use. However, parental monitoring was associated with a beneficial impact on substance use intentions, attitudes, and norms among children who were abstinent. These findings suggest that the protective influence of parental monitoring may differ among Latinx children depending on the individual substances examined and whether children have already engaged in use. In addition to monitoring, direct supervision of children can also negatively impact early substance initiation by influencing peer group selection and provides fewer opportunities for use (Van Ryzin, Fosco, & Dishion, 2012).

The remaining parenting practices, skills building, positive involvement, and problem solving are all important aspects of parental involvement. This general construct is measured differently in various research and has been consistently found to negatively impact early substance use through improved academic performance across gender and ethnicity (Pilgrim, Schulenberg, O'Malley, Bachman, & Johnston, 2006). Parental involvement has also been independently associated with greater adolescent self-regulation and reduced alcohol and tobacco use (Wong, 2008). Parental involvement is especially salient between childhood to early adolescence before peer influences assume a more prominent influence on substance use during middle to late adolescence (Olds & Tombs, 2001). These parental influences –monitoring/supervision, skills building, positive involvement, problem solving, and effective discipline—create important circles of protection for children at a critical developmental juncture.

1.3 Substance specific communication

Public prevention efforts in both the United States and Mexico have called for parents to communicate with their children regarding the consequences of substance use. Research suggests that parent-child communication may protect against early substance initiation. For example, non-substance specific parent-child communication has been found to protect boys against alcohol and tobacco use (Luk, Farhat, Iannotti, & Simons-Morton, 2010). However, substance specific parental communication regarding alcohol and tobacco use may not be associated with early adolescents' substance use initiations (Ennett, Bauman, Forshee, Pemberton, & Hicks, 2001). No known research has examined the impact of substance specific parent-child communication among Latinx youth during childhood when parental influences may be especially salient.

1.4 Parental illicit substance use

Parental illicit substance use has been identified as a significant risk factor for childhood substance use (Kilpatrick et al., 2000). Many children exposed to parental illicit substance use experience psychological, medical, and behavioral problems (Smith & Wilson, 2016). In contrast, children of non-using parents are less likely to select substance using peer groups or engage in substances use (Li, Pentz, & Chou, 2002). Research suggests that interventions targeting parenting skills and family functioning among children exposed to parental illicit substance use may improve developmental trajectories (Calhoun, Conner, Miller, & Messina, 2015). Thus, while parental substance use has the potential to negatively impact children's development, developing parenting skills and competencies may improve outcomes among children whose parents use illicit substances.

1.5. Current study

The present study sought to examine the impact of parental factors on substance use and use intentions within a nationally representative sample of Mexican children (i.e., 5th and 6th grade). Our aims were (a) to examine the potential impact of positive parenting practices (i.e.,g involvement, skills building, monitoring), substance specific communication, direct supervision, and parental substance use on childhood lifetime substance use, and (b) determine whether these parenting factors impact intentions to engage in substances for the first time. Based on previous research, we hypothesized that higher levels of positive parenting would be related to lower odds of reporting substance use and intentions. We also expected parental illicit substance use to be a significant risk factor for child reported lifetime substance use and use intentions. We also hypothesize that children who have high degrees of direct parental supervision would have lower odds of reporting substance intentions and use. Finally, we did not expect parent-child substance specific communication to be a significant predictor of substance use and intentions.

2. Method

2.1. Participants and procedures

Data for the present study include 52,171 elementary students (5th and 6th grade) that participated in the National Survey of Drug Use Among Students (Encuesta Nacional de Consumo de Drogas en Estudiantes; ENCODE) in Mexico in 2014. Inclusion criteria for the current study was being at school on the day of data collection, and being in the 5th or 6th grade. Table 1 has complete demographic information. ENCODE data is cross-sectional. Schools were randomly selected from each state in Mexico to form a nationally representative sample of elementary age students. The ENCODE team used uniform

collection and data management procedures across schools. Participants completed paper surveys in a 70 min group session. Survey questions were read out loud to the students in their classrooms to reduce developmental language barriers (See Villatoro Veláquez et al. 2016 for additional methodological information). The Secretary of Public Education in Mexico provided ENCODE representative's permission to survey students and train school staff in data collection. Active consent was not obtained from parents as the Secretary of Public Education granted the consent to survey students. Students provided assent at the outset of the survey and those that did not wish to participate could elect to do so. The (masked for review) Institutional Review Board approved the use of ENCODE data for the current study.

The ENCODE team conducted validity checks and eliminated inconsistent responders on substance use outcomes (e.g., zig zag responses; inconsistency between lifetime use and last 30 day use for each substance; $n = 476$; 0.009%) from the original dataset ($N = 52,647$). The current study confirmed the validity of intentions outcomes by examining response consistency across a variety of indicators (e.g., last year, 30 days use, lifetime use by first time substance intentions). Responses were consistent for all outcomes with the exception of other substance use intentions, which had 1,450 (2.8%) inconsistent responders. As responses were consistent for all other use and intentions outcomes, inconsistent responders were only removed from analysis examining other substance use intentions.

2.2. Measures

2.2.1. Survey information. All measures used in the current study were developed and utilized by the ENCODE team in prior research seeking to understand patterns and

predictors of substance use among Mexican students (Villatoro Velázquez et al., 2016; Villatoro Velázquez et al., 2017).

2.2.2. Child characteristics. Participants self-reported demographic information such as age, gender, and grade. An "overage" variable was generated to represent participants who were above the typical age for their respective school grades (i.e., 5^{th} = ages 10-11 and 6^{th} = ages 11-12; Vázquez et al., 2019). In the 5^{th} grade, overage children were 12 to 15 years of age. In the 6^{th} grade, overage children were 13 to 15 years of age.

2.2.3. Substance intentions and use. Participants were asked to report on lifetime substance use on five items queried alcohol, tobacco, marijuana, inhalant, and other substance use. Specifically, these questions asked students to report whether they had tried a full glass of an alcoholic beverage (i.e., beer, wine, rum, tequila), smoked tobacco or cigarettes, and used/tried marijuana, inhalant, and other substances during their lifetime. Participants indicated whether they had past use, *yes* (1) or *no* (0), for each substance. Intention to use substances was measured using substance specific items. Participants who had not previously initiated in substances use were asked to rate the likelihood that they would engage in alcohol, tobacco, or other substances use (i.e., substances other than alcohol and tobacco) for the first time on a 4-point scale: *not likely* (1), *likely* (2), *very likely* (3), *I already consume alcohol* (4). Dichotomous substance use intentions variables were created by coding responses for those who reported that they were "likely" or "very likely" to use substances as *probable* (1), while those who reported that it was "not likely*"* were coded as *not probable* (0).

2.2.4. Parenting quality. A 20-item questionnaire was used to assess child perceptions of parenting practices, which was developed by the ENCODE team and

based on the Alabama Parenting Questionnaire (APQ; Shelton, Frick, & Wootton, 1996). The current study utilized the full-scale score which represents several domains associate with parenting quality such as involvement (e.g., aware of who friends are, include child in actives, attend school meeting), skills building (e.g., reward or affection for good behavior, encourage good effort), monitoring of peers (e.g., supervising online activity and chatting with peers, when going out parents know with whom and where they are going), and neglect (e.g., so busy that that forget where the child is, leave child alone). This provides a measure that is consistent with the overall goal of parent management training programs, which seek to promote a variety of practices associated with positive outcomes among children (Forgatch & Domenech Rodríguez, 2016). Responses were: *never* (1), *sometimes* (2), *frequently* (3), *very frequently* (4). A mean was taken of all 20 items with higher score representing greater degrees of positive parenting behaviors. Internal consistency within the current sample was good ($\alpha = 0.83$).

2.2.5. Direct supervision. Participants were asked to rate how much of the day they spent unsupervised at home without their parents. Responses were recorded on a single item with responses being *most of the day* (1), a *part of the day* (2), *never or almost never* (3).

2.2.6. Substance specific communication. Students were asked whether their parents had conversations associated with substance use within the last six months on four questions (i.e., rules, abstinence advice, use of substance in media, discuss others problems caused by drugs). They responded *yes* (1) or *no* (0). These questions were combined into an index score ranging from 0-4, with higher scores representing a greater number of substance specific communication.

2.2.7. Parental illicit substance use. Participants were asked to report whether their mother and father had used substances other than alcohol and tobacco on two items. Responses were reported as *yes* (1) or *no* (0). A variable was created to examine difference in risk among children who reported *individual* (1) and *dual (2)* parental illicit substances use relative to those who reported that their caregivers abstain from drug use (0).

2.3. Data analytic plan

In the overall dataset, 29.9% (n = 15,610) of participants were missing at least one covariate. Multiple imputations were used to estimate missing values as this method is preferred over casewise deletion (Enders, 2010). When data missingness exceeds 10%, it is recommended that individual items be imputed as this approach outperforms mean item imputation (Eekhout et al., 2014). Furthermore, researchers have recommended using twenty multiple imputation datasets when variable missingness is between 10-30% (Graham, Olchowski, & Gilreath, 2007). We followed these recommendations to reduce the chances of biased missing value estimates. The analysis was conducted in two steps using SPSS. We first created the twenty datasets with independent imputation scenarios. In the second step, demographic variables were covaried to control for age (i.e., grade, overage) and gender. Independent binary logistic regression analyses were then conducted in each dataset to examine predictors of substance intent and use. Results across datasets were pooled into a single output for each outcome (i.e., average of parameter estimates across datasets; Enders, 2010). These results can be interpreted in the same manner as a standard logistic regression (see Tables 2 and 3).

3. Results

3.1. Substance use

Rates of lifetime substance use in the current sample were 8,954 (17.2%) alcohol, 3,626 (7%) tobacco, 1,435 (2.8%) marijuana, 1,130 (2.2%) inhalants, and 1,002 (1.9%) other substances. Several parenting variables demonstrated consistent importance across substance use indicators while controlling for child age and gender. Unit increases in positive parenting were associated with lower odds of reporting lifetime use of all substances (see Table 2). Children that reported illicit substance use by an individual parent were twice as likely to report use of alcohol, three times for tobacco and marijuana use, and five times for inhalants and other substance use relative to children with non-using parents. Children who reported that both of their parents used illicit substances were three times more likely to report alcohol use, five times for tobacco use, eight times for marijuana use, ten times for inhalants use, and eleven times for other substance use relative to children with non-using parents. Substance specific parent-child communication was not significantly related to lifetime use for the majority of substances examined. The only exception was inhalant use; with a unit increase in substance specific communication being associated with a negligible reduction in the odds of reporting use. Children who reported that they were being unsupervised for "part of the day" or "most of the day" were more likely to report lifetime use of alcohol, tobacco, marijuana, and inhalants relative to those who were "never or almost never" left unsupervised. Direct supervision was only associated with an increase in the odds of reporting use among children who reported being unsupervised "most of the day" relative to the comparison group. However, the increased odds of reporting substance use among children who were

unsupervised “part of the day” (i.e., 22-37%) or “most of the day” (i.e., 15-94%) were small for the majority of outcomes in relation to the comparison group.

3.2. Substance intentions

Rates of substance intentions in the current sample were 2,841 (5.4%) for alcohol, 5,369 (10.3%) for tobacco, and 3,094 (6.1%) for other substances. Parenting factors were also important across substance intentions indicators while controlling for child age and gender. A unit increase in positive parenting was associated with reduction in the odds of reporting alcohol, tobacco, and other substance intentions (see Table 3). Children who had a parent that used illicit substances had small increases in the odds of reporting intentions to use tobacco (i.e., 42%) and other substance (i.e., 40%) relative to those with non-using parents. Children who reported that both of their parents used illicit substances were consistently at greater risk of reporting use intentions across substances relative to those with non-using parents. Children reporting that they were unsupervised for “part of the day” or “most of the day” were at in increased risk for reporting intentions to use tobacco and other substances relative to those who were “never or almost never” left unsupervised. However, increases in the odds of reporting tobacco and other substance use intentions among children that were unsupervised “part of the day” (i.e., 25% for both) or “most of the day” (i.e., 22% for tobacco, 47% for other substances) were small in relation to the comparison group. Direct supervision was not related to alcohol use intentions. Substance specific parent-child communication was also not significantly related to substance use intentions.

4. Discussion

In all, our findings show that the largest increases in risk for substance use and intention was associated with parental illicit substance use. In contrast the largest reduction in odds were associated with increases in positive parenting practices across indicators of substance intentions and use. Data from the present study may aid substance use prevention efforts targeting vulnerable Latinx populations. Luckily, these efforts are well underway in México where research to examine the relevance, acceptability, and effectiveness of a culturally-adapted evidence-based parenting program has shown excellent promise (Amador et al., 2019). The current findings suggest that it may be useful to step-up dissemination and implementation efforts.

Child reported parental illicit substance was associated with the most significant increases in risk for lifetime use of all substances examined. The impact is greater when both parents are using illicit substances as compared to only one parent. These findings are consistent with work in the United States showing that parental illicit substance use may impact substance use and use intentions prior to adolescence (Li et al., 2002). Also consistent with previous research in the United States, higher levels of positive parenting practices were associated with lower odds of child reported lifetime use and use intentions across substances examined (Wong, 2008; Yabiku et al., 2010). These findings suggest that children's perceptions of their caregivers' use of positive parental practices can impacting their risk for initiating in both licit and illicit substance use. Consistent with previous research on adolescents in the United States, substance specific parent-child communication was not related to report of lifetime substance use or use intentions among Latinx children in Mexico (Ennett et al., 2001). The only exception was inhalant use; our results suggest that substance specific-communication had a negligible reduction

in risk for inhalant use. Lower levels of direct supervision were generally associated with small increase in the odds of reporting substance use or intentions. However, there was a pronounced difference in risk for reporting the use of illicit substances (i.e., 69% marijuana, 94% inhalants, 65% other substances) among children who were unsupervised "most of the day" relative to the reference group. These findings may reflect greater youth opportunities for engaging in illicit substance use when they spend the majority of the day away from their parents watchful eye (Van Ryzin et al., 2012).

4.1. Implications

Findings suggest that the influence of parental illicit substance use may significantly impact substance initiation in the pre-adolescence period. Targeted research and prevention efforts may be useful in delaying substance initiation and promoting positive developmental trajectories among children exposed to parental illicit substance use. Positive parenting practices are important above and beyond the impact of parental illicit substance use. Research already documents the benefits of treating both parental illicit substance use and providing parenting skills training for substance abusing families to address child behavior problems and improve family functioning (Calhoun et al., 2015; Li et al., 2002) in the United States. Our data suggests this course of action may be worth examining in Mexico. Furthermore, parenting intervention programs may consider promote direct supervision to reduce childhood risk for illicit substance use when family circumstances are amenable.

Overall, findings suggest that what parents say about substance use is less influential than what they do (i.e., parental substance use, involvement, monitoring). Engaging positive parenting practices is also an action on the part of parents that seems to

protect children, in contrast with substance specific parent-child communication which may unwittingly send the message “do as I say not as I do”.

5. Limitations

The findings of the current study should be viewed in light of several limitations. As substance specific communication was limited to four questions within the current study (i.e., rules, abstinence advice, use of substance in media, discuss others problems caused by drugs), future research may consider examining the impact of other forms of parental communication (e.g., consequences for use, expectations) on substance initiation among Mexican children. Furthermore, the current study relied on individual items to measure direct supervision and parental illicit substance use. Additional research is needed to confirm these findings with more robust measures of direct supervision and parental illicit substance use. Administration of the survey in classrooms may have also increased the chances of socially desirable responding. As students may worry about the reactions of teachers or classmates to their response. I should be noted, that findings from the current study may also not generalize to Latinx populations outside of Mexico. Lastly, as the current study utilized cross-sectional data, we cannot establish the causal ordering of parenting factors and child substance intentions/use since they were measured concurrently. Thus, further research is needed to examine the impact of parenting factors on substance initiation among Mexican children longitudinally.

6. Conclusions

Children’s perceptions of their caregiver’s behavior and parenting skills can significantly impact their risk for substance initiation. Findings suggest that preventions efforts may benefit from targeting family level risk factors such as parental illicit

substance use and significant amounts of unsupervised time during the period leading up to adolescences. Findings of the current study provide strong support for the implementation and dissemination of parenting skills interventions focused on increasing positive parental practices to mitigate risk of substance use among Mexican children. When transporting survey knowledge to implementation packages, it is critically important to generate prevention programs that are centered on the communities in which they are intended to be used. Cultural adaptation meta-analyses have shown the benefits of adapting programs (Soto et al., 2018). Scholarship points to the importance of avoiding cultural imperialism that could be associated with the thoughtless exportation of research methods and psychological interventions (Domenech Rodríguez et al., 2018). In all, the findings point to the importance of what parents model for their children –either use or effective parenting—in the lives of their children.

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Table 1

Demographics (N = *52,171*)

Variables	*n* (%)
Age *M (SD*)	10.40 (.82)
5th Grade	31,219 (59.8)
Overage	1,488 (2.9)
Boys	26,477 (50.8)
Family composition	
Both parents	37,258 (71.4)
Step-mother	3,419 (6.6)
Step-father	3,587 (6.9)
Parent illicit substance use	
Individual	3,648 (7)
Both	1,268 (2.4)
Child substance use	
Alcohol	8,954 (17.2)
Tobacco	3,626 (7)
Marijuana	1,435 (2.8)
Inhalants	1,130 (2.2)
Other substances[a]	1,002 (1.9)
Child substance intentions	
Alcohol	2,841 (5.4)
Tobacco	5,369 (10.3)
Other substances[b]	3,094 (6.1)

Note: [a]includes substances such as cocaine, methamphetamine, [b]substances other than alcohol and tobacco.

Table 2.

*Parenting Predictors of Lifetime Substance Use from Aggregated Logistic Regression Analysis on Multiple Imputations Datasets (*N = *52,171)*

	Alcohol	Tobacco	Marijuana	Inhalants	Other Substances[a]
	OR [95% CI]	OR [95% CI]	OR [95% CI]	OR [95% CI]	OR [95% CI]
Boys[1]	1.88* [1.79-1.98]	2.06* [1.91-2.22]	2.44* [2.15-2.76]	2.23* [1.94-2.56]	2.25* [1.94-2.60]
6th Grade[2]	1.24* [1.18-1.30]	1.25* [1.16-1.34]	0.92 [0.82-1.03]	0.81* [0.71-0.92]	0.89 [0.78-1.02]
Overage[3]	1.43* [1.27-1.62]	2.20* [1.90-2.54]	1.89* [1.52-2.35]	1.80* [1.41-2.31]	2.19* [1.71-2.79]
Positive parenting[4]	0.62* [0.59-0.65]	0.45* [0.42-0.49]	0.40* [0.35-0.45]	0.42* [0.35-0.47]	0.41* [1.71-2.79]
Communication[5]	1.01 [1.00-1.03]	1.00 [0.97-1.02]	0.98 [0.95-1.02]	0.93* [0.89-0.98]	0.98 [0.93-1.02]
Unsupervised[6]					
Part of the day	1.22* [1.15-1.29]	1.25* [1.14-1.36]	1.25* [1.09-1.44]	1.37* [2.26-2.60]	1.14 [0.96-1.35]
Most of the day	1.15* [1.08-1.23]	1.47* [1.34-1.60]	1.69* [1.47-1.94]	1.94* [1.66-2.26]	1.65* [1.40-1.94]
Parental drug use[7]					
One parent	2.42* [2.24-2.60]	3.26* [2.96-3.58]	4.82* [4.22-5.50]	5.17* [4.46-5.99]	5.69* [4.87-6.64]
Both parents	3.43* [3.05-3.85]	5.01* [4.37-5.74]	8.36* [7.08-9.87]	10.37* [8.70-12.35]	11.42* [9.51-13-71]

Note: OR = odds ratio; 95% CI = 95% confidence interval. Table presents pooled results from five analyses performed on the five multiple imputated datasets. [a]includes substances such as cocaine, methamphetamine, etc. [1]relative to girls, [2]relative to 5th grader, [3]relative to appropriate age for grade, [4]relative to unit increase in positive parenting practices, [5]relative to unit increase in substance specific communication, [6]relative to never or almost never unsupervised, [7]relative to no illicit substance use. * $p < .05$.

Table 3.

Parenting Predictors of Substance Use Intentions from Aggregated Logistic Regression Analysis on Multiple Imputations Datasets

	Alcohol (n = 23,008) OR [95% CI]	Tobacco (n = 45,287) OR [95% CI]	Other Substances[a] (n =43,515) OR [95% CI]
Boys[1]	1.05 [0.97-1.14]	1.24* [1.17-1.31]	1.11* [1.03-1.19]
6th Grade[2]	0.96 [0.88-1.04]	0.92* [0.86-0.97]	0.84* [0.78-0.90]
Overage[3]	0.97 [0.76-1.25]	0.98 [0.82-1.17]	1.05 [0.86-1.30]
Positive parenting[4]	0.62* [0.57-0.68]	0.54* [0.51-0.57]	0.50* [0.47-0.54]
Communication[5]	0.99 [0.96-1.02]	1.01 [0.98-1.03]	1.02 [0.99-1.04
Unsupervised[6]			
Part of the day	1.07 [0.97-1.18]	1.25* [1.17-1.34]	1.25* [1.15-1.37]
Most of the time	1.11 [1.00-1.23]	1.22* [1.13-1.32]	1.47* [1.34-1.62]
Parental drug use[7]			
One parent	1.18 [1.00-1.39]	1.42* [1.27-1.57]	1.40* [1.22-1.59]
Both parents	1.60* [1.22-2.10]	1.71* [1.43-2.04]	1.53* [1.23-1.92]

Note: OR = odds ratio; 95% CI = 95% confidence interval. Table presents pooled results from five analyses performed on the five multiple imputated datasets. [a]includes substances other than alcohol and tobacco. [1]relative to girls, [2]relative to 5th grader, [3]relative to appropriate age for grade, [4]relative to unit [5]relative to unit increase in substance specific communication, [6]relative to never or almost never unsupervised, [7]relative to no illicit substance use. * $p < .05$.

CHAPTER IV

MACHINE LEARNING TO PREDICT SUBSTANCE USE

The following chapter is a pre-printed version of an accepted manuscript titled, Innovative Identification of Substance Use Predictors: Machine Learning in a National Sample of Mexican Children. The authors were Alejandro L. Vázquez, Melanie M. Domenech Rodríguez, Tyson S. Barrett, Sarah Schwartz, Nancy G. Amador Buenabad, Marycarmen N. Bustos Gamiño, María de Lourdes Gutiérrez López, Jorge A. Villatoro Velázquez. This manuscript was accepted for publication in *Prevention Science* on January, 2020. The pre-print follows the journal publication format requirements. The published article can be found at the following link: https://doi.org/10.1007/s11121-020-01089-4

Innovative Identification of Substance Use Predictors: Machine Learning in a National Sample of Mexican Children

Rising rates of substance use among children and adolescents is an emerging global trend (United Nations Office on Drugs and Crime [UNODC], 2018). Mexico follows this trend, signaling a need to identify specific factors associated with early substance use to inform targeted prevention efforts (Villatorro Velázquez et al., 2016). Factors impacting early substance use may be broad in breadth and scope. Socioecological frameworks have highlighted the complex interplay between a myriad of individual (e.g., age, gender, risk taking, self-efficacy) and socio-ecological (i.e., school, home, community) factors that can contribute to early initiation in substance use (Bronfenbrenner, 1977). Researchers have predominately relied on traditional statistical methods to examine these influences but face several challenges when examining the

large number of factors that can be associated with substance initiation (e.g., variable normality, multicollinearity, family-wise error rate; Breinman, 2001; Lehmann & Romano, 2012). Recent advancements in computational power and machine learning provide an alternative and complimentary understanding, as these methods can examine large numbers of variables without the constrains of traditional methods, maximizing researchers' ability to identify variables that provide the highest levels of discriminatory prediction (e.g., substance users or non-users; Chollet & Allaire, 2018). The current study applied machine learning algorithms to the examination of a wide variety of factors to determine their importance in predicting lifetime substance use among Mexican children.

Substance Use in Mexico

The prevalence of lifetime substance use among Mexican children (i.e., 5th, 6th grade) is 16.9% for alcohol, 6.5% for tobacco, and 3.3% for illicit substances (e.g., marijuana, inhalants; Villatoro Velazquez et al., 2016). These statistics suggest that the prevalence rates of lifetime alcohol and tobacco use among Mexican children have overtaken those of adolescents in the US (i.e., ages 12-17; 9.2% alcohol, 5.3% tobacco; SAMHSA, 2017). This is concerning as research in the US has documented the detrimental impact of early substance use on development trajectories (e.g., development of adulthood medical and psychological disorders; Wymbs et al., 2014). High rates of early use may foreshadow an impending public health crisis as rates of substance use increase within the context of limited services to address substance use disorders (Borges et al., 2009). One potential solution may be to utilize targeted prevention programs to equip children and families with the skills necessary to navigate common risk factors prior to developmental periods were youth engage in higher rates of substance use (i.e.,

roughly age 13 in Mexico; Villatoro Veláquez et al., 2016). However, studies in Mexico and the US have predominantly focused on substance use after age 12, which has resulted in a dearth of knowledge regarding risk and protective factors for substance use prior to adolescence (Benjet et al., 2007; Johnston et al., 2018; SAMHSA, 2017; Villatoro Veláquez et al., 2013; Villatoro Veláquez et al., 2017). Exploring a wide range of factors known to impact early use in other contexts (e.g., US) and age groups (e.g., adolescence) could help determine their importance in predicting substance use among Mexican children, providing important information for early prevention and intervention programs.

Individual Factors

Individual characteristics associated with elevated risk for substance use among Mexican children are being: a boy, indigenous, non-religious, or above the developmentally appropriate age for their grade (Vázquez et al., 2019a). In addition to demographic risk factors, researchers in the US have also identified individual attitudes and behaviors that could impact risk for substance use during adolescence such as: self-esteem (Zamboanga, Schwartz, Jarvis, & Van Tyne, 2009), future academic aspirations (Paulson, Coombs, & Richardson, 1990), school engagement (Li & Lerner, 2011), perceive danger of use (Johnston et al., 2018), and sensation seeking (Sargent, Tanski, Stoolmiller, & Hanewinkel, 2010). Research is needed to determine whether these perceptions and behaviors associated with substance use among adolescents in the US extend to children in Mexico.

Socio-ecological Factors

The context that children inhabit can also impact their decisions about and opportunities for engaging in substance use. Mexico has high levels of poverty (43.6%; The World Bank, 2016), is experiencing increases in crime (i.e., robberies and assaults, motor vehicle theft, home burglary; National Institute of Statistics and Geography [INEGI], 2018), and is a major manufacturer of drugs intended for distribution abroad (UNODC, 2018). As a result, significant number of children may be exposed to low resource and high crime neighborhoods, which are known risk factors for substance use among adolescents in the US (Burdzovic Andreas & Watson, 2016). Furthermore, urban centers in Mexico have been found to have higher rates of poverty and crime relative to rural areas (INEGI, 2018; UNODC, 2018), which may contribute to higher rates of tobacco and illicit substance use among urban students relative to their rural counterparts (Villatorro Velázquez et al., 2017).

Parental influences may be especially salient during childhood, making this a potentially high value socio-ecological factor for targeted substance use prevention programs (Olds & Tombs, 2001). In the US, family structure (intact, single parent, step-parent), parenting practices (e.g., skills building, problem solving, positive involvement, effective discipline, and monitoring; Dishion, Kavanagh, & Kiesner, 1999; Patterson, 2005), parental illicit substance use (Li, Pentz, & Chou, 2002), and parental expectations and consequences regarding use (Luthar, Small, & Ciciolla, 2014; Messler, Quevillon, & Simons, 2014) have all been found to be associated with early substance use. In Mexico, substance specific parent-child communication and parental illicit substance use (Vázquez et al., 2019b) have been associated with early substance use. Examining parenting factors among a wide variety of predictors could improve our understanding of

the relative importance of caregiver factors on substance use and may provide specific high value intervention points for parent management training programs.

While parental influences outweigh those of peers during childhood (Olds & Tombs, 2001), children may be especially susceptible to deviant peers that promote substance use as their ability to resist these influences does not manifest until late adolescence (e.g., age 14-18; Hussong, 2002). The literature consistently highlights the adverse effects of deviant peers and protective effects of prosocial peer relations on substance use among adolescents in the US (Gilliard-Matthews et al., 2015; Hussong, 2002; Kliewer et al., 2007). However, no studies to date have examined peer influences on substance use in Mexican children. Examination of a wide range of peer characteristics and behaviors could add nuance to the understanding of childhood substance use in Mexico.

Challenges

Identifying factors associated with substance use during the pre-adolescent period may be invaluable in narrowing prevention efforts to those that may be at the greatest risk. However, methodological and structural barriers may exist to the study of substance use among Mexican children. For example, children in Mexico exhibit lower base rates of substance use relative to middle to late adolescents (Villatorro Velázquez et al., 2016), which may necessitate larger samples to ensure sufficient power to identify predictors of early use. Large publicly available datasets may offer a low-cost method of studying substance use in Mexico's population but may be fraught with issues (e.g., data cleaning, effective visualization, limited number of predictors can be included in models; Mohr, Burns, Schueller, Clarke, & Klinkman, 2013).

Machine learning prediction models such as elastic net, k-nearest neighbors, neural networks, and random forest may prove to be important screening tools that can identify variables associated with early substance use (Hastie, Tibshirani, & Friedman, 2009). Elastic net is a linear method that creates sparse models and selects variables based on their ability to provide discriminatory prediction (e.g., substance use or non-use; Barrett & Lockhart, 2018). K-nearest neighbors is a multidimensional approach, which utilizes pattern recognition to classify data based on its proximity to *k* neighboring points based on Euclidean distances (Mucherino, Papajorgji, & Pardalos, 2009). Neural networks is a non-linear approach that mimics the functioning of neurons in the human brain by utilizing hidden layers, or connections between predictors to maximize classification accuracy (Hastie et al., 2009). Finally, random forest is a non-linear prediction model based on classification and regression trees (CART), but differs from CART in that predictions are not identified from individual trees, but rather from a large aggregation of trees, increasing predictive accuracy (James, Witten, Hastie, & Tibshirani, 2013). Observed relevance across prediction models results in higher confidence that variables identified as important are indeed relevant.

Machine learning approaches have been used to identify variables that best predict suicide (Baca-Garcia et al., 2007), Post-Traumatic Stress Disorder (Marinić et al., 2007), depression (Drinovac et al., 2015), and utilization of mental health services (Rossi, Amaddeo, Sandri, & Tansella, 2005). However, researchers have yet to utilize machine learning methods to identifying factors most associated with early substance use. Thus, our aim was to conduct exploratory analyses to (a) examine machine learning's ability to classify childhood substance use, and (b) identify specific factors that best discriminated

between children who engaged in lifetime substance use (i.e., alcohol, tobacco, marijuana, inhalants) and those who had not.

Methods

Sample and Procedures

The present study drew from a national survey on substance use: The National Survey of Drug Use Among Students (Encuesta Nacional de Consumo de Drogas en Estudiantes; ENCODE; Villatorro Velázquez et al., 2016), which included 191,880 elementary, middle, and high school students. Data for the present study included 52,171 5th and 6th graders (M_{age} = 10.40, SD_{age} = 0.82). Children were eligible to participate if they were a student in a selected school and present during the period the survey was administered. The non-response rate was 20% within our sample, mostly indicating absences. See Table 1 for sample demographic by lifetime substance use. For additional information on demographic predictors of lifetime substance use among Mexican children see Vázquez and colleagues (2019a).

The ENCODE team was provided consent to survey students by the Secretary of Public Education in Mexico. Active parental consent was not obtained as the Secretary of Public Education provided consent to survey students. Student assent was obtained prior to completion of the survey. Students who did not want to participate engaged an alternative activity at the time of data collection. ENCODE representatives trained school staff in the implementation of surveys within schools. School were randomly selected from each state in Mexico to create a nationally representative sample of students. Data was collected using uniform measurement, data collection, and data handling procedures in a cross-sectional design. Participants completed paper-based surveys in a 70 min group

session. Prompters read questions aloud for elementary age students to reduce developmental language barriers. The ENCODE team utilized validity checks (e.g., zig zags, inconsistent responses between lifetime and 30-day use), to identify and remove inconsistent responders from the current sample (n = 476; 0.009%). Approval to perform analyses on the archived, deidentified data was obtained from the Institutional Review Board at [masked for peer review]. Approval for the parent project was obtained from [masked for peer review].

Measures

All measures used in the current study have been used by the ENCODE team on previous studies examining substance use among Mexico's student population (Villatorro Velázquez et al., 2016). Rather than analyzing scales, we used individual items to provide fine grain detail regarding predictors of lifetime substance use. Machine learning approaches allowed us to screen large amounts of variables and rank them according to their ability to discriminate between lifetime substance users and non-users. See online supplement for individual items.

Individual predictors. Participants reported their age, gender, and grade. We created an "overage" variable to represent individuals who were above the typical age for their respective grades (i.e., 5^{th} = ages 10-11 and 6^{th} = ages 11-12; Vázquez et al., 2019a). Participant indigenous heritage was assessed with an individual item, "Of the people that live in your home does someone speak an indigenous language?", rated as *yes* or *no*. Religiosity was assessed with a single item, "How important is it for you to go to church or temple", with responses ranging from 1-3: *not important*, *somewhat important*, *very important*. Participants were asked if their school performance at the time of assessment

had *improved, stayed the same,* or *worsened* from the previous academic school year. Three items assessed participant future aspirations regarding school completion (i.e., elementary, middle, high school). Responses were: *very likely, somewhat likely, not likely*. Self-esteem was assessed over four items asking participants to report whether they possessed good qualities, held positive attitude towards self, were overall satisfied with themselves, and could do things as well as others (from Rosenberg, 1965). Participants responded *yes* or *no* on individual items. Four items addressed whether participants had engaged in the following sensation seeking behaviors: exploring strange places, doing risky things, having daring friends, and breaking rules to experience new sensations. Participants responded *yes* or *no* on individual items. Participants reported whether it was *dangerous* or *not dangerous* to drink alcohol, smoke 1 cigarettes a day, smoke 5 cigarettes a day, smoke marijuana, or use inhalants.

Socio-environmental predictors. Eight items assessed aspects of participants' communities. Four focused on neighborhood insecurity (i.e., crime near school, presence of criminals, robberies, worry about being outside alone outside) and the other on positive community aspects (e.g., well-kept parks, green areas, feeling safe walking in their neighborhood, enjoying playing in parks near home). Participants responses were: *yes, somewhat, no*. Participants reported on the type of community they resided in (e.g., large city, medium city, small city, village, rural settlement). Family composition was measured on four individual questions (i.e., father, mother, step-father, step-mother). We created variables to represent children living with both biological parents or single parents (i.e., father or mother). Parenting practices were measured using 20 items adapted from the Alabama Parenting Questionnaire (APQ; Shelton, Frick, & Wootton, 1996).

Participants reported their perceptions of different parenting practices and behaviors exhibited by their caregivers (i.e., involvement, skills building, monitoring, neglect). Responses were: *never, sometimes, often, very often*. Participants answered four *yes* or *no* questions regarding parent-child substance specific communication during the last six months (i.e., rules regarding the use of drugs, tips for avoiding drugs, use of substances in media, discuss problems other people experience because of drug use). Students completed seven questions assessing parent expectations pertaining to substance use (e.g., parents would find out about and punish substance use, importance of following rules). Responses were reported as *yes* or *no*. Participants reported separately on whether their mother, father, or best friend used drugs other than alcohol and tobacco, responding *yes* or *no*. Lastly, eight items assessed peer characteristics and behaviors (i.e., go to school, play sports, have good grades, smoke cigarettes, drink alcohol, use marijuana/inhalants, problems with parents, struggle in school).

Outcomes. Participants responded to four individual items querying whether they had ever tried a full glass of an alcoholic beverage (i.e., beer, wine, rum, tequila), smoked tobacco or cigarettes, used/tried marijuana or inhalants during their lifetime. Reponses were dichotomous *yes* or *no*.

Analytic Plan

Within the current sample, 21,211 (40.7%) participants were missing at least one predictor. Prior to imputation, data was randomly partitioned into training (i.e., 41,738; 80%) and test sets (i.e., 10,433; 20%). Imputation was conducted independently for training and test sets using mode imputation, wherein missing values were replaced with the mode. Mode imputation is commonly utilized within the context of machine learning

and is recommended over methods such as casewise deletion (Enders, 2010; Rahman & Davis, 2013). As algorithms can struggle to predict the positive class when there are low base rates, down sampling was used to randomly resample and reduce the negative class (i.e., non-substance user) until it was equal to the positive class (i.e., substance user) for each outcome (Kuhn & Johnson, 2013). In our sample, the training sets were n = 14,328 for alcohol, n = 5,802 for tobacco, n = 2,296 for marijuana, n = 1,808 for inhalants, indicating, for example, that there were 7,164 participants that reported alcohol use and 7,164 that reported no use. Four dissimilar classification algorithms were then fitted to the training set to create prediction models for each substance use indicator: Elastic net, k-nearest neighbors, neural networks, and random forest (Hastie et al., 2009). Each model included 75 variables representing child individual and socio-ecological factors. Ten-fold cross-validation was used to identify variables that best predicted group membership across random subsets of participants within the training set (James et al., 2013). We assessed variables based on their average relative importance across models within the training set. A crosstab visualization mosaic was used to identify variable levels associated with elevated risk for reporting substance use. Model performance was then assessed on a test set using the area under (AUC) the receiver operating characteristic (ROC) curve, which represents a model's ability to correctly classify group membership across all possible cutoffs (AUC < 70 = poor, 70 – 80 = acceptable, 80-90 = excellent, > 90 = outstanding discrimination; Kuhn & Johnson, 2013; Hosmer, & Lemeshow, 2000).

Results

Alcohol. Within the training set, 7,164 (17.2%) children reported that they had tried at least one full drink of an alcoholic beverage. Classification models identified best

friend illicit substance use, respondent sex, friend alcohol use, danger of frequent alcohol use, father illicit substance use, and friend cigarette use as the most important factors in differentiating between lifetime alcohol users and non-users within the training set. See Figure 1 for variable importance. Visual inspection of mosaic crosstabulations suggests that illicit substance use by best friends and fathers, friend alcohol and cigarette use, being a boy, and perceiving frequent alcohol use as not being dangerous were all associated with a greater proportions of reported lifetime alcohol use. See supplemental Figures S1 – S6 for mosaic visualizations. AUC for alcohol use classification models ranged from poor to acceptable discrimination (i.e., AUC = 0.653-0.756) within the training set (n = 1,790, 17.2% for lifetime alcohol use). Elastic net was the best preforming algorithm in predicting group membership for lifetime alcohol use within the training set according to AUC (i.e., 0.756). See Figure 2 ROC curves for lifetime alcohol use.

Tobacco. Within the training set, 2,901 (7%) children reported having smoked tobacco or cigarettes at least once. Classification algorithms identified best friend illicit substance use, friend cigarette use, father illicit substance use, respondent sex, and friend alcohol use as the top predictors of group membership for lifetime tobacco use within the training set. See Figure 3 for variable importance. Similar to alcohol, visual inspection of mosaic crosstabulations suggests that illicit substance use by best friends and fathers, friend alcohol and cigarette use, and being a boy were associated with greater proportions of reported lifetime tobacco use within the training set. See supplemental Figures S7-S11 for mosaic visualizations. AUC for tobacco use classification models ranged from acceptable to excellent discrimination (i.e., AUC = 0.744 – 0.814) within the test set (n =

725, 6.9% for lifetime tobacco use). Random forest (i.e., AUC = 0.814) and elastic net (i.e., AUC = 0.813) were excellent classifiers for lifetime tobacco use according to AUC. See Figure 4 for ROC curves.

Marijuana. Within the training set, 1,148 (2.8%) children reported having tried marijuana at least once in their lifetime. Consistent with lifetime alcohol and tobacco use models, best friend illicit substance use was the most important and consistent predictor of marijuana use. See Figure 5 for variable importance. Father illicit substance use, respondent sex, and friend cigarette use were also important factors in classifying lifetime marijuana use. Mosaic crosstabulations suggest that children who reported illicit substance use by their best friends and fathers, cigarette use among friends, and that they were boys had the greatest proportion of lifetime marijuana use. See supplemental Figures S12-S15 for mosaics visualizations. Model validation on the test set yielded AUC values ranging from acceptable to excellent (i.e., AUC = 0.784 – 0.847; n= 287, 2.8% for lifetime marijuana use). Elastic net was the best classifier of lifetime marijuana use (i.e., AUC = 0.847). See Figure 6 for ROC curves.

Inhalants. Within the training set, 904 (2.2%) children reported that they had tried to get high through the use of inhalants at least once in their lifetime. Best friend illicit substance use, respondent sex, father illicit substance use, and perceived danger of inhalant use. See Figure 7 for variable importance. Mosaic crosstabulations suggest that illicit substance use by best friends and fathers, being a boy, and not perceiving inhalants as dangerous were all factors associated with a greater proportion of lifetime inhalant use. See supplemental Figures S16-S19 for mosaics visualizations. Important variables identified in the training set, provided acceptable to excellent discrimination within the

test set for lifetime inhalant use (i.e., AUC = 0.794-0.873; n = 226, 2.2% for lifetime inhalant use). Random forest (i.e., AUC = 0.873) and elastic net (i.e., AUC=0.867) were excellent classifiers of lifetime inhalant use and had the largest AUC values relative to alcohol, tobacco, and marijuana use models. See Figure 8 for ROC curves.

Discussion

The current study expands the literature by utilizing novel statistical methods to explore a wide range of factors and identify those that best predict lifetime substance use among Mexican children. Our findings identified illicit substance use (i.e., drugs other than alcohol or tobacco) by best friends and fathers, and respondent sex (i.e., boys) as consistent and strong predictors of group membership across outcomes. These findings may represent the impact of paternal and peer influences, and sex-based differences in children's decisions to engage in early substance use. Furthermore, these variables produced AUC values generally ranging from acceptable to excellent, providing us with confidence in the importance of these factors in predicting lifetime substance use. Therefore, addressing paternal and peer illicit substance use among boys may be promising targets for existing programs seeking to delay the onset of substance use among Mexican children. While these factors appear to be important cross-sectional markers of substance use, further research is needed to evaluate the importance of these factors longitudinally to inform the optimization of existing prevention programs targeting early substance use.

Our findings also highlight the importance of peer influences and perceived danger in predicting early substance use among Mexican children. Friend cigarette use was a strong predictor of lifetime use across a variety of substances (i.e., alcohol,

tobacco, marijuana), while friend alcohol use was specifically predictive of lifetime alcohol and tobacco use. These findings suggest that peer influences that are known to impact substance use during adolescence in other context are also strong predictors of early use among Mexican children. Furthermore, perceived danger of engaging in frequent alcohol and inhalant use predicted lifetime alcohol and inhalant use respectively. These findings suggest that educating children on the danger of alcohol and inhalant use may be potential avenues for substance use prevention programs in Mexico.

It is important to put these findings in context. The prediction models were stronger for tobacco, marijuana, and inhalants when compared to alcohol use. The prediction of alcohol use in a validation sample, while acceptable, suggests that there is room for exploration for the addition of variables that may be uniquely relevant for children, for example, access to alcoholic beverages in the home is a relevant yet unmeasured construct that may be relevant for school-aged children who spend long hours at home (Friese & Grube, 2008; Wadolowski et al., 2016). The examination of these predictors using multiple algorithms and validation data provided us with unique confidence in our findings. We recommend the continued exploration of different machine learning algorithms to determine whether there are other approaches that offer improved performance in predicting the use of particular substances.

Implications

Machine learning has the potential to aid in risk screening by allowing researchers to examine a wide range of factors and determine their importance in predicting outcomes in populations of interest. Given the myriad of factors influencing substance use, machine learning may assist policymakers in narrowing substance use prevention

programs in context with limited structural and financial resources. Variables identified as being of high importance within the current study may assist in screening and connecting at risk Mexican children with targeted substance use prevention services. Our findings suggest that asking about illicit substance use by best friends and fathers, and respondent sex (i.e., boys) can assist in determining who may report use across substances (i.e., alcohol, tobacco, marijuana, inhalants). Future studies should examine these important predictors longitudinally to determine their ability to classify future use and explore the feasibility of automated risk screening and targeted prevention efforts guided by machine learning.

Screening variables of interest with machine learning may also reduce the subjective nature of variables selection in highly dimensional data and ensure the inclusion of variables with the most relevant information in studies seeking to understand mechanisms associated with early substance use (Barrett & Lockhart, 2018; Breiman, 2001). Researchers should consider examining important classifiers identified in the current study when building substance specific explanatory models examining the impact of individual and socio-ecological factors on early use among Mexican children. Furthering our understanding of potential mechanisms underlying early substance use may contribute to the optimization of existing prevention programs by narrowing efforts and identifying high value targets for intervention.

Limitations

Findings of the current study should be considered exploratory in nature. Prediction models used for the current study do not imply causal mechanisms relating to substance use but rather factors that are strong predictors of group membership. Further

research is needed to understand the mechanisms that may explain the importance of variables identified in the current study in their relation to substance use. The current study utilized cross-sectional data, collecting information regarding predictors and substance use at the same time. Thus, it is possible that substance use may have preceded predictors examined within the current study. The current study utilized child self-reports. It is possible that children misunderstood survey questions or were confused about what was being asked. While children appear to be capable of self-reporting on health variables (Riley, 2004; Varni, Limbers, & Burwinkle, 2007), substance use reporting accuracy might vary (Shillington & Clapp, 2000). Future research should consider utilizing caregiver report of child individual and socio-ecological factors to determine whether risk/protective factors for substance use differ between child and parent report. Important factors identified within the current sample may not generalize to youth in other contexts or developmental stages. Future research should also examine a wider range of predictors of substance use at different developmental stages and context.

Conclusions

Machine learning has the potential to help researchers and policymakers identify solutions to complex societal problems (Breinman, 2001). Mexican policymakers seeking to address rising rates of substance use among children may consider integrating machine learning into public health assessment surveys to maximize their ability to identify those with the greatest risk. Within the context of Mexico, measures of best friend and father illicit substance use (i.e., drugs other than alcohol or tobacco), and respondent sex (i.e., boys) appear to be high impact screening questions. Research is needed to determine whether utilizing these high impact screening questions may reduce the cost of

implementing prevention programs through improved identification of at-risk children. Efforts are also needed to determine the feasibility and effectiveness of utilizing machine learning models for automated risk screening.

Compliance with Ethical Standards

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Disclosure of potential conflicts of interest: The authors have declared that they have no competing or potential conflicts of interest.

Ethical approval: Approval to perform analyses on the archived, deidentified data was obtained from the Institutional Review Board at [masked for peer review]. Approval for the parent project was obtained from [masked for peer review]. All research actives were performed in accordance with the ethical standards articulated in the 1964 Declaration of Helsinki, its later amendments, and the 1979 Belmont Report.

Informed consent: The Secretary of Public Education in Mexico provided the ECODE team consent to survey students. Active parental consent was not obtained as the Secretary of Public Education provided the consent to survey students. Student accented to participation prior to the administration of the survey and those that did not want to participate could chose to do so.

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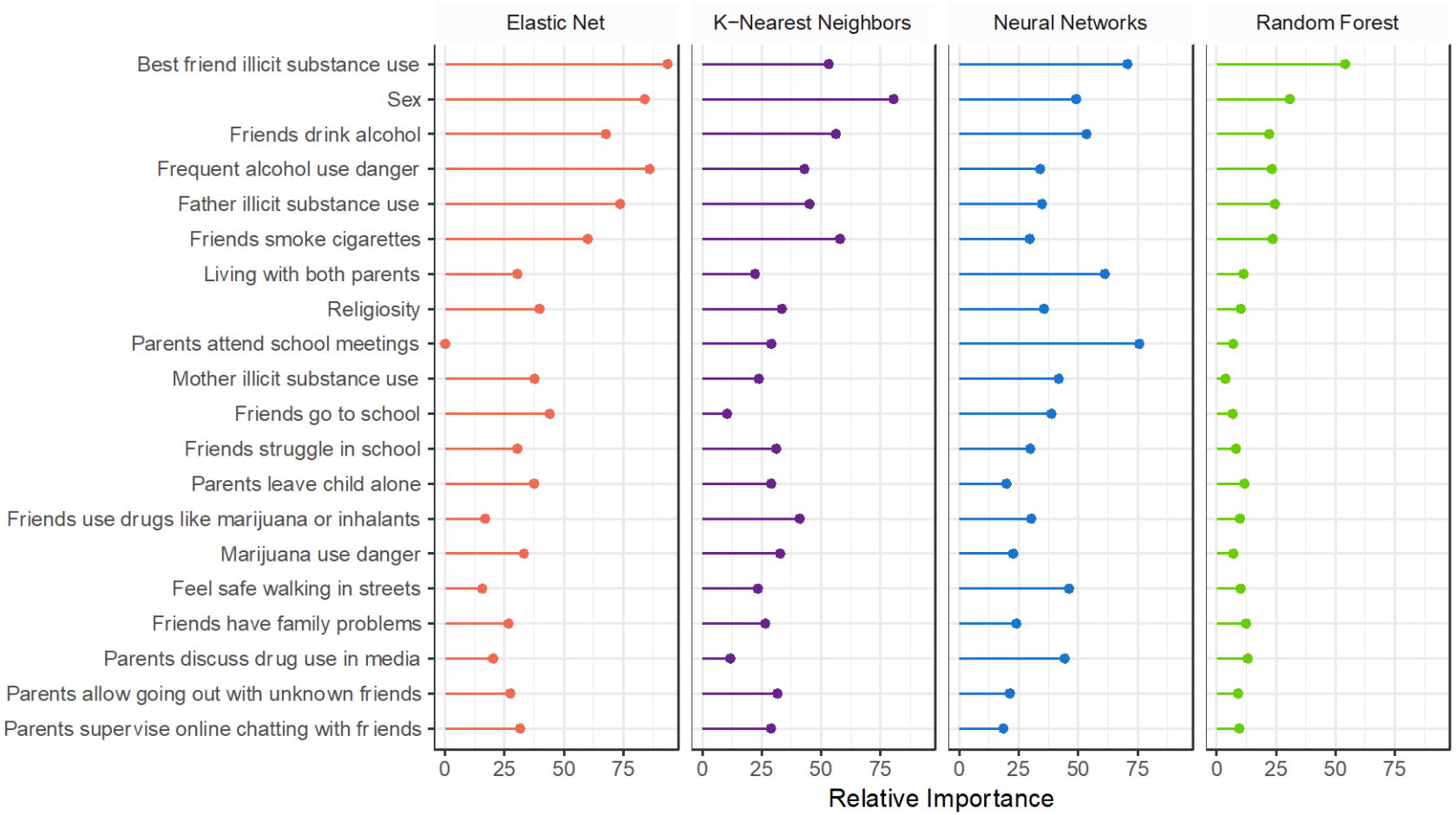

Figure 1. Relative importance of individual and socio-ecological factors in predicting group membership for lifetime alcohol use. Top 20 variables with the highest average relative importance across models.

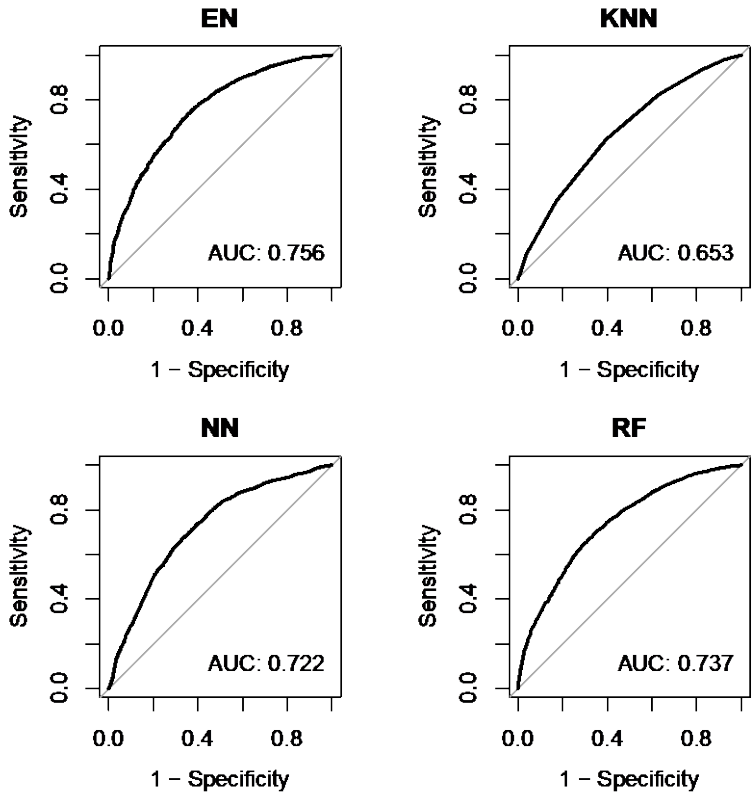

Figure 2. ROC curve estimating AUC for models classifying lifetime alcohol use within the test set. EN = Elastic Net, KNN = K-nearest neighbors, NN = Neural networks, RF = Random forest.

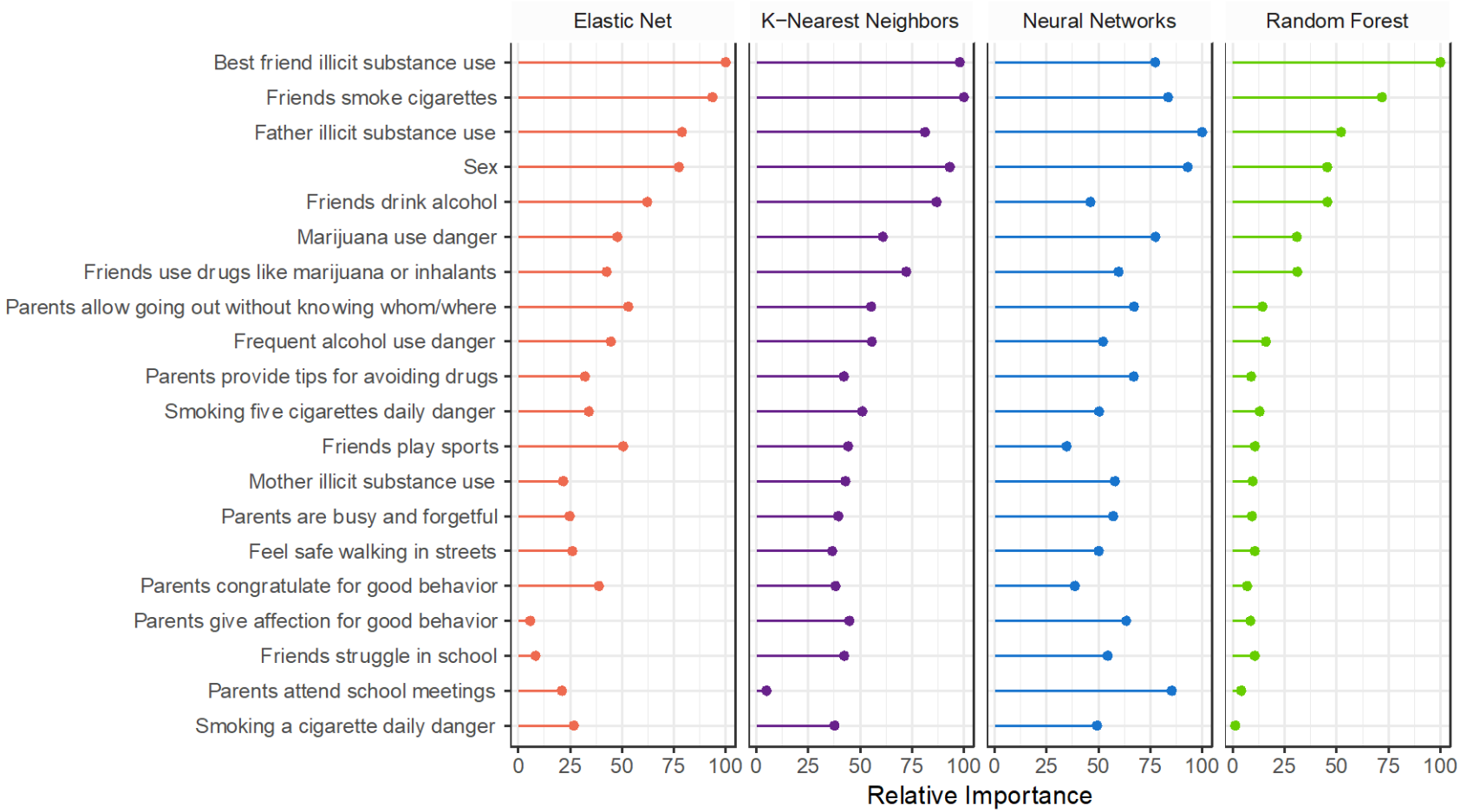

Figure 3. Relative importance of individual and socio-ecological factors in predicting group membership for lifetime tobacco use. Top 20 variables with the highest average relative importance across models.

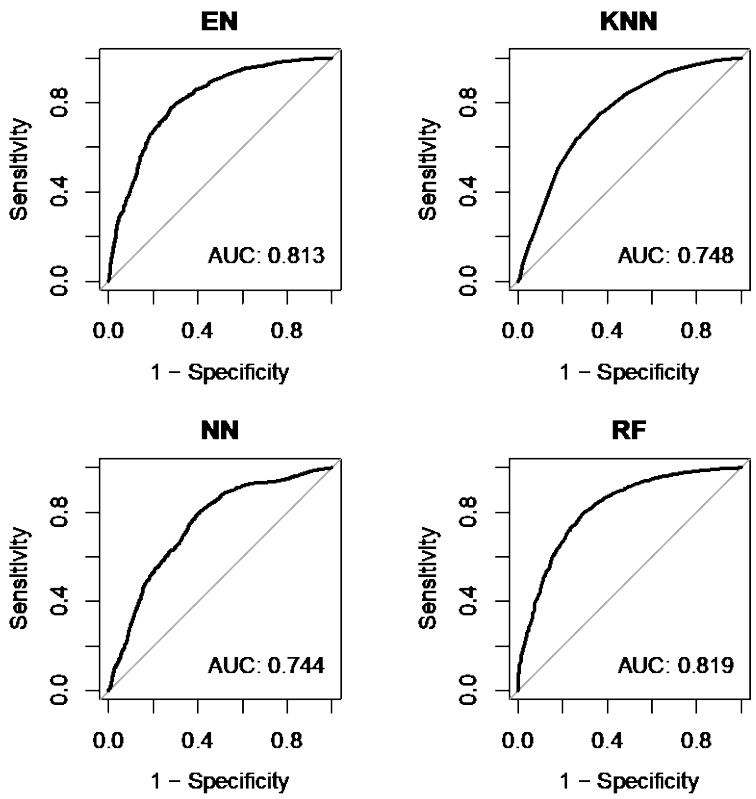

Figure 4. ROC curve estimating AUC for models classifying lifetime tobacco use within the test set. EN = Elastic Net, KNN = K-nearest neighbors, NN = Neural networks, RF = Random forest

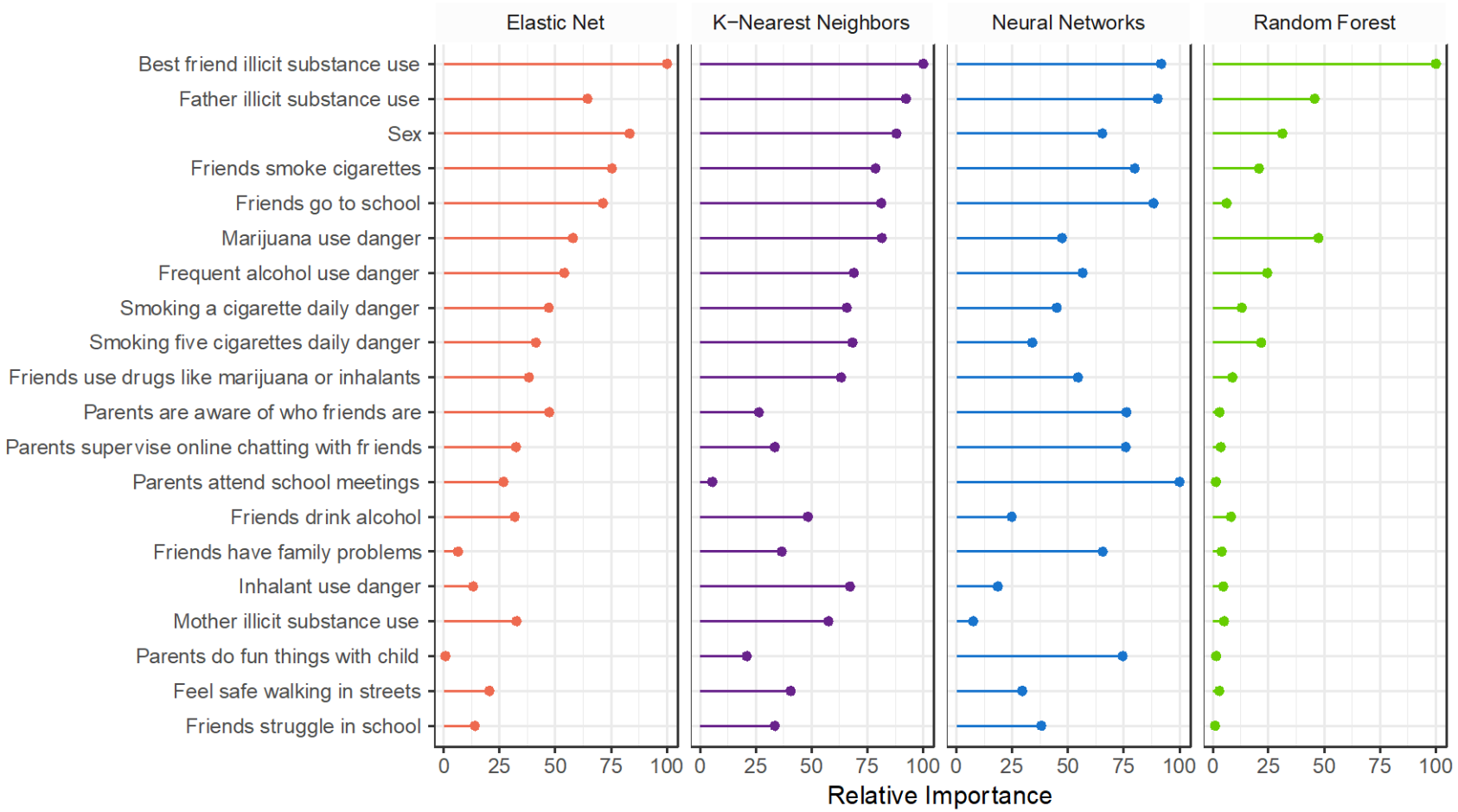

Figure 5. Relative importance of individual and socio-ecological factors in predicting group membership for lifetime marijuana use.

Top 20 variables with the highest average relative importance across models.

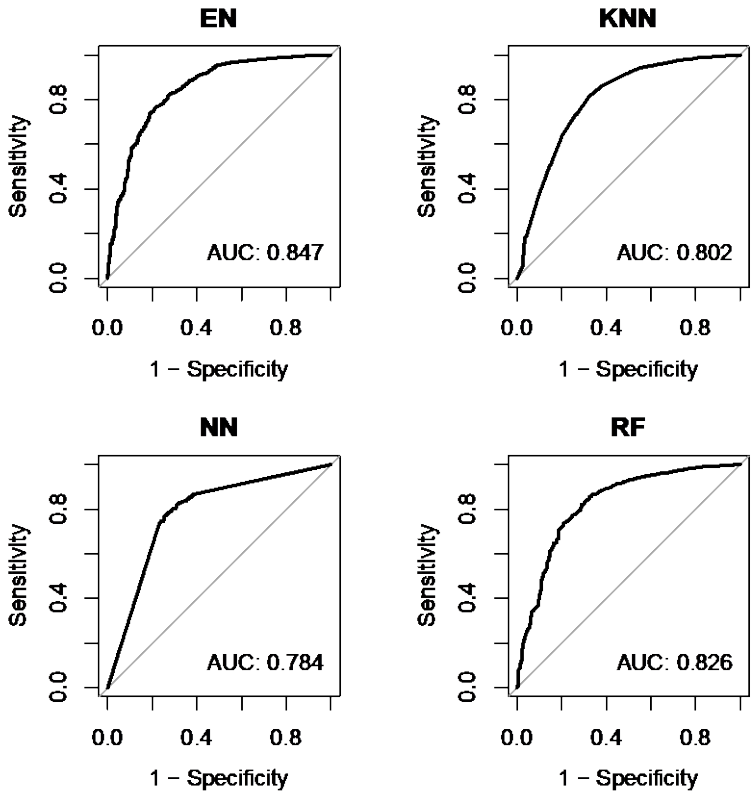

Figure 6. ROC curve estimating AUC for models classifying lifetime marijuana use within the test set. EN = Elastic Net, KNN = K-nearest neighbors, NN = Neural networks, RF = Random forest

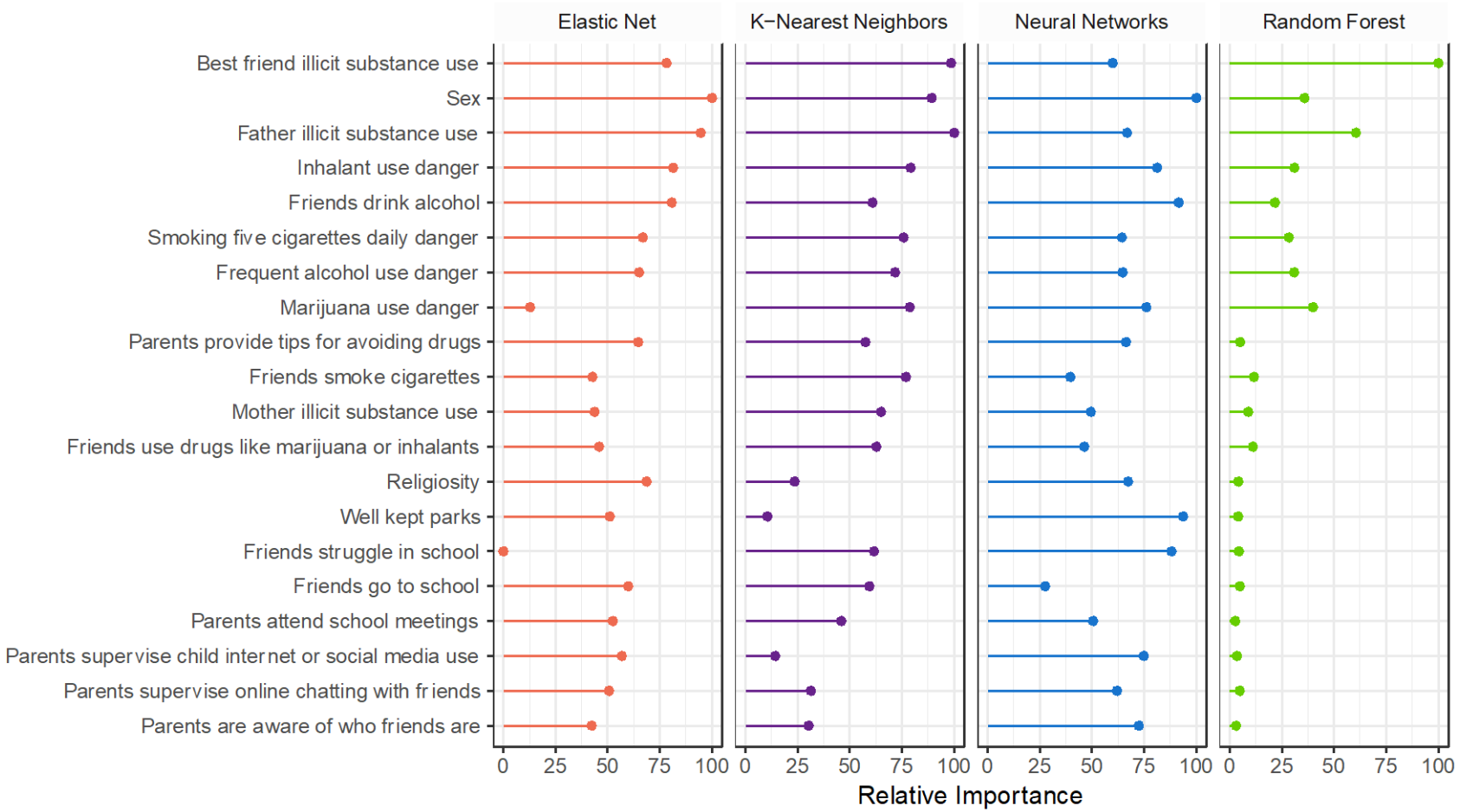

Figure 7. Relative importance of individual and socio-ecological factors in predicting group membership for lifetime inhalant use.

Top 20 variables with the highest average relative importance across models

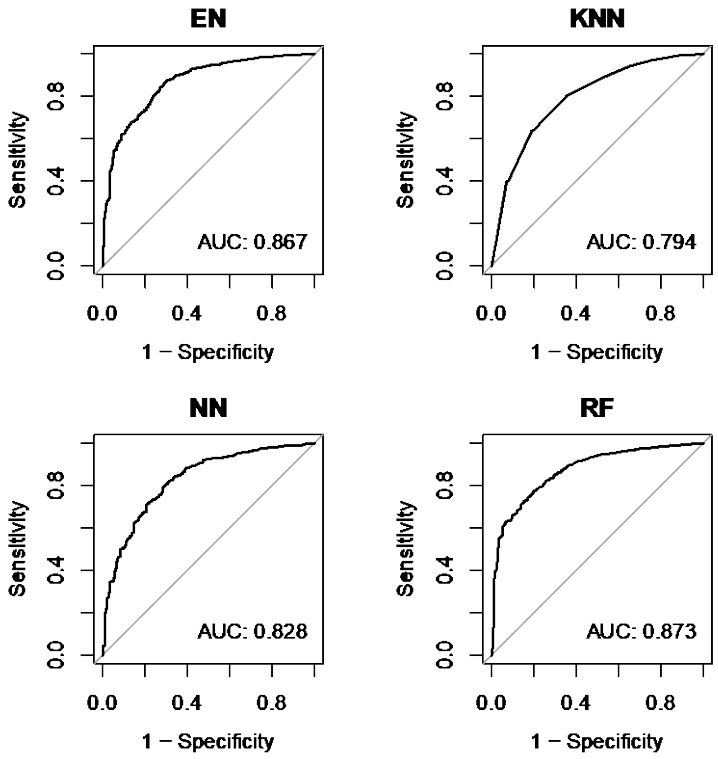

Figure 8. ROC curve estimating AUC for models classifying lifetime inhalant use within the test set. EN = Elastic Net, KNN = K-nearest neighbors, NN = Neural networks, RF = Random forest.

Table 1.

Sample Demographics by Lifetime Substance Use.

	Lifetime Alcohol[a] (n = 8,954;17.2%)	Lifetime Tobacco[a] (n = 3,626; 7%)	Lifetime Marijuana[a] (n = 1,435; 2.8%)	Lifetime Inhalants[a] (n = 1,130; 2.2%)	Overall[b] (n = 52,171)
Sex					
Boy	5,866 (22.2%)	2,546 (9.6%)	1,078 (4.1%)	836 (3.2%)	26,477 (50.8%)
Girl	3,088 (12.0%)	1,080 (4.2%)	357 (1.4%)	294 (1.1%)	25,694 (49.2%)
Grade					
5th	5,073 (16.2%)	2,067 (6.6%)	921 (3.0%)	760 (2.4%)	31,219 (59.8%)
6th	3,881 (18.5%)	1,559 (7.4%)	514 (2.5%)	370 (1.8%)	20,952 (40.2%)
Overage					
Typical age	8,560 (16.9%)	3,371 (6.7%)	1,331 (2.6%)	1,049 (2.1%)	50,683 (97.1%)
Older than typical age	3,94 (26.5%)	2,55 (17.1%)	104 (7.0%)	81 (5.4%)	1,488 (2.9%)
Ethnicity					
Non-indigenous	7,078 (16.4%)	2,710 (6.3%)	991 (2.3%)	760 (1.8%)	43,060 (82.5%)
Indigenous	1,536 (20.0%)	700 (9.1%)	322 (4.2%)	248 (3.2%)	7,682 (14.7%)
Religiosity					
Not important	787 (23.9%)	349 (10.6%)	183 (5.6%)	137 (4.2%)	3,294 (6.3%)
Somewhat important	3,012 (19.3%)	1,111 (7.1%)	365 (2.3%)	279 (1.8%)	15,609 (29.9%)
Very important	4,637 (15.0%)	1,857 (6.0%)	700 (2.3%)	554 (1.8%)	30,974 (59.4%)
Community Type					
Large city	2,488 (17.6%)	1,047 (7.4%)	440 (3.1%)	337 (2.4%)	14,122 (27.1%)
Medium city	2,466 (16.0%)	909 (5.9%)	342 (2.2%)	276 (1.8%)	15,444 (29.6%)
Small city	1,186 (17.4%)	488 (7.1%)	190 (2.8%)	136 (2.0%)	6,835 (13.1%)
Town	1,860 (18.0%)	720 (6.9%)	242 (2.3%)	187 (1.8%)	10,362 (19.9%)
Rural settlement	569 (16.1%)	259 (7.3%)	97 (2.7%)	87 (2.5%)	3,541 (6.8%)

Note: [a] represents row frequency/percentage for substance specific use by demographic variables. [b] represents column frequency/percent for each demographic variable.

CHAPTER V

SUMMARY AND CONCLUSIONS

This dissertation sought to address the dearth of knowledge regarding substance use predictors among Mexican children. Three manuscripts provided insight into demographic, parental, and ecological influences that were associated with early substance initiation. Findings from these studies may informing prevention programming within Mexico and in countries with sizeable Latinx populations.

Our investigation of demographic characteristics associated with childhood substance intentions/use uncovered important information with implications for prevention programing in Mexico. Rates of lifetime alcohol and tobacco use within a sample of Mexican children were nearly that of adolescent in the United States (i.e., alcohol 9.2%, tobacco 6.5%; Villatoro Velazquez et al., 2016; SAMHSA, 2017). This finding suggests a need for accessible substance use prevention programs for Mexican children. Our analysis identified several consistent predictors of lifetime substance use that may narrow prevention programs. Children who were boys, non-religious, and above the developmentally appropriate age for their grade were especially at risk for lifetime use across substances (i.e., alcohol, tobacco, marijuana, inhalants, other substances). These demographic risk factors may be of clinical utility for professionals seeking to identify vulnerable Mexican children in need of referral for preventative services. Our analysis also uncovered higher rates and risk for substance intentions/use among indigenous heritage children relative to their non-indigenous counter parts. These findings suggest that indigenous children may be an especially vulnerable population in

need of additional clinical attention to address elevated risk for intent for and use of substances.

Research has documented the importance of parents in shaping child substance use outcomes (Voisine, Parsai, Marsiglia, Kulis, & Nieri, 2008). Findings from our second manuscript affirm this, suggesting that actions on the part of the parent can increase (i.e., illicit substance use) or decrease (i.e., positive parenting) a child's risk for substance initiation. We also learned that parent-child communication regarding substance use did not significantly impact child reported lifetime use or use intentions, with the exception of a minor reduction in risk for lifetime inhalant use. These results suggest that what parents say about substance use is less influential than what they do (i.e., parental substance use, positive parenting, supervision). Substance use prevention programs in Mexico may consider promoting positive parenting practices, while addressing parental illicit drug use when present to delay the onset of substance use among children (Calhoun et al., 2015; Li et al., 2002).

Our third manuscript utilized machine learning algorithms to screen a wide variety of individual and socioecological factors to determine their value in discriminating between Mexican children that had used substances from those that have not. Machine learning algorithms utilizing information on individual and socioecological factors achieved classification accuracies for substance use ranging from acceptable to excellent. Algorithms identified three high value predictors of use across substance (i.e., alcohol, tobacco, marijuana): best friend and father illicit substance use and respondent sex (i.e., boys). These findings suggest that questions regarding best friend and father illicit substance use and child sex are high impact screening questions for lifetime

substance use among Mexican children (i.e., 5th and 6th grades). Our findings highlight machine learning potential as a method of narrowing prevention efforts and drawing new insight from publicly available data.

Challenges and opportunities

Our research represents a first step towards increasing the feasibility of early substance use prevention programs in Mexico. While our findings may assist with screening children for substance use risk, challenges persist to the dissemination of prevention efforts within Mexico (Borges et al., 2009). Creative solutions are needed to meet these challenges and increase access to prevention programs. Mexico researchers may consider adapting evidence-based prevention programs from U.S. to work within their context or could seek to develop home-grown methods of interventions (Domenech Rodríguez et al., 2018). Researchers in Mexico have recognized the availability of qualified professionals as a limiting factor for substance abuse treatment (Borges et al., 2009). Researchers in the U.S. have shown that para-professionals could be trained to effectively administer evidence-based practices, which provides a potential avenue for increasing access to mental health services (Lakind, Cua, Mehta, Rusch, & Atkins, 2019). Future research may also consider increasing our understanding of service formats that Mexican caregivers associate with specific child psychopathology (Vázquez & Villodas, 2019). Identifying acceptable service formats may provide opportunities to integrate evidence-based practices into services formats that caregivers may be more likely to use.

Future directions

This dissertation has contributed to the literature by identifying behavioral markers associated with substance initiation among Mexican children. However, these

findings represent a first step towards understanding mechanisms associated with early substance use initiation. Machine learning analysis identified several promising behavioral markers associated with substance initiation among children. Future research may expand on our findings by including important factors identified in this research in explanatory models of childhood substance use. Researchers should also determine the importance of cross-sectional factors identified in the current study in predicting substance use longitudinally. Sharpening our understanding of mechanisms underlying childhood substance use is essential to the success of prevention programing in Mexico and abroad.

The current dissertation utilized individual items to examine a wide variety of constructs in relation to lifetime substance use among Mexican children. We utilized individual items due to poor internal consistency of scales (i.e., neighborhood quality, peer deviant behavior), or the lack of more robust measures (e.g., indigenous heritage, religiosity) due to constraints associated with the feasibility of prevention needs surveys (e.g., survey length and time). As a result, potentially complex construct such as religiosity were examined dichotomously, which may oversimplify a continues and multidimension behavior (Allport, & Ross, 1967). As multi-item scales are known to be superior to individual items, we recommend that future research confirm our findings using multi-item measures of child individual and socioecological influences (Diamantopoulos, Sarstedt, Fuchs, Wilczynski, & Kaiser, 2012).

Machine learning is a promising method for accelerating the development of the knowledge base on childhood substance use predictors. Researchers can improve upon our work by applying machine learning algorithms to longitudinal date. This may aid the

development of automated screening methods powered by machine learning that can accurately funnel children at risk for future use into prevention programs. Further research is needed to determine the feasibility and efficacy of automated screening methods utilizing machine learning. While it is impossible to capture all aspects of a child's individual characteristics and environment, future research should consider exploring additional factors beyond those examined within the current study. This is particularly relevant for lifetime alcohol use, which had the lowest level of classification accuracy within the current study. All analysis for this research were conducted in the R statistical environment, which is open source software. These tools reduce structural barriers to international research that can stymie efforts to identify local risk factors and development context specific interventions (Domenech Rodríguez et al., 2018). We encourage researchers to apply machine learning to their data to identify high value predictors of early substance use across context.

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SUPPLIMENTAL MATERIALS

Table S1.

Outcomes and Predictors: Item Descriptions.

Labels	Questions
Outcomes	
Lifetime Alcohol	Have you ever tried a full glass of an alcoholic beverage, such as beer, wine, rum or tequila?
Lifetime Tobacco	Have you ever smoked tobacco or cigarettes in your life?
Lifetime Marijuana	Have you ever taken, used or tried marijuana in your life?
Lifetime Inhalants	Have you ever taken, used or tried inhalants in your life to get high?
Individual Factors	
Demographic	
Gender	You are: girl or boy
Grade	What is the grade you are studying at the school?
Overage	N/A
Ethnicity	Of the people who live in your house, does anyone speak an indigenous language?
Religiosity	How important is it for you to go to church or to the temple?
Academic	
Academic Performance in Last Year	Compared to last year, do consider that your grades today have:
Sensation Seeking	
Explore Strange Places	Explore strange places
Doing Risky Things	Doing risky things
Rule Breaking	Experience new emotions, although sometimes you have to break the rules
Have Daring Friends	Have friends who are daring
Self-Esteem	
Having Good Qualities	I feel that I have good qualities
Can Do Things Well	I am able to do things as well as most people
Positive Attitude Towards Self	I have a positive attitude towards myself
Satisfied with Self	In general, I am satisfied with myself
Future Academic Aspirations	
Expect to Finish Elementary	Do you finish primary school?
Expect to Pass School Year	Do you pass the school year?
Expect to Go to High school	Do you go to high school?
Perceived Harm	
Marijuana use danger	Use marijuana
Frequent alcohol use danger	Use alcohol frequently
Smoking five cigarettes daily danger	Smoking 5 or more cigarettes a day
Smoking a cigarette daily danger	Smoking 1 or more packs of cigarettes per day
Inhalant use danger	Use inhalants
Socio-ecological Factors	
Community Type	The place where you have lived most of your life, was or is:
Neighborhood Quality	
Worry Outside Alone	I worry about going outside alone.
Robberies Near School	There are many robberies by my school.
Neighborhood Criminals	In my neighborhood there are many criminals.
Neighborhood Robberies	There are many robberies in my neighborhood.
Green Areas Near Home	Through my house there are green areas with trees and flowers
Feel Safe Walking in Streets	I feel safe walking the streets of my neighborhood
Like Going to Parks Near Home	I like to go out and play at the parks that are near my house

Well Kept Parks	The parks near my house are well cared for
Peer Influences	
Friends Go to School	Go to school?
Friends Smoke Cigarettes	Smoke cigarettes?
Friends Play Sports	Play any sport?
Friends Get Good Grades	Have good grades at school?
Friends Have Family Problems	They have problems with their parents?
Friends Drink Alcohol	Do they consume alcoholic beverages?
Friends Use Drugs	Do they consume drugs such as marijuana or inhalants?
Friends Struggle in School	Do you consider that the school's tasks are difficult?
Family Structure	Who do you live with?
Lives with both parents	N/A
Lives with step father	Living with your step-father?
Lives with step mother	Living with your step-mother?
Parent drug use	Have any of these people used any type of drug? (other than alcohol or tobacco)
Father illicit drug use	Your Father?
Mother illicit drug use	Your Mother?
Parenting Practices	
Aware of friends	They are aware of who your friends are
Reward good behavior	When you obey or behave yourself, they reward you with extra things (doing things together, gifts, etc.)
Encourage good effort	They encourage you to do things as well as possible
No curfew rules	They allow you to leave without establishing a time of arrival
Congratulate for good work	They congratulate you when you do a task or work well
Out without knowing whom/where	They let you go out without knowing where or with whom you are going
Out with unknown friends	They allow you to go out with friends that they do not know
Congratulate for good behavior	When you behave well, they congratulate you
Affection for good behavior	They give you kisses and hugs when you do things right
Busy and forgetful	They are so busy that they forget where you are
Leave child alone	They leave you alone
Teach new activities/task	They teach you to do activities or tasks that are new to you
Include child in activities	They include you when they plan family activities
Attend school meetings	Attend school meetings (conferences, school meetings, etc.)
Do fun things with child	They do fun things with you
Involved in child activities	Are involved in the activities that interest you (school, sports)
Talk about child's friends	They talk with you about your friends
Supervise internet/social media	They supervise you when you are on the internet or social networks
Supervise online chatting	They supervise you when you are chatting online with your friends
Check-in with teachers	Talk with your teachers to find out how you are going in school
Parent-child substance use communication	
Drug use rules	Rules about the use of drugs?
Tips for avoiding drug use	Tips to stay away from drugs?
Discuss drug use in media	Use of drugs in movies, music and television?
Discuss others drug problems	People who have had problems due to drug use?
Parent substance use rules/expectations	
Parents would realize alcohol use	My parents would realize if I drank alcohol
Clear rules about alcohol	My parents have given me very clear rules about the consumption of alcoholic beverages
Important of following alcohol rules	It is important for me to abide by the rules my parents have about drinking alcohol
Important of following drug rules	It is important for me to follow the rules my parents have about using drugs
Parents would realize marijuana use	My parents would realize if I used drugs like marijuana
Parents would punish alcohol/tobacco use	My parents would punish me if I used alcohol or tobacco
Parents would punish drug use	My parents would punish me if I used drugs like marijuana

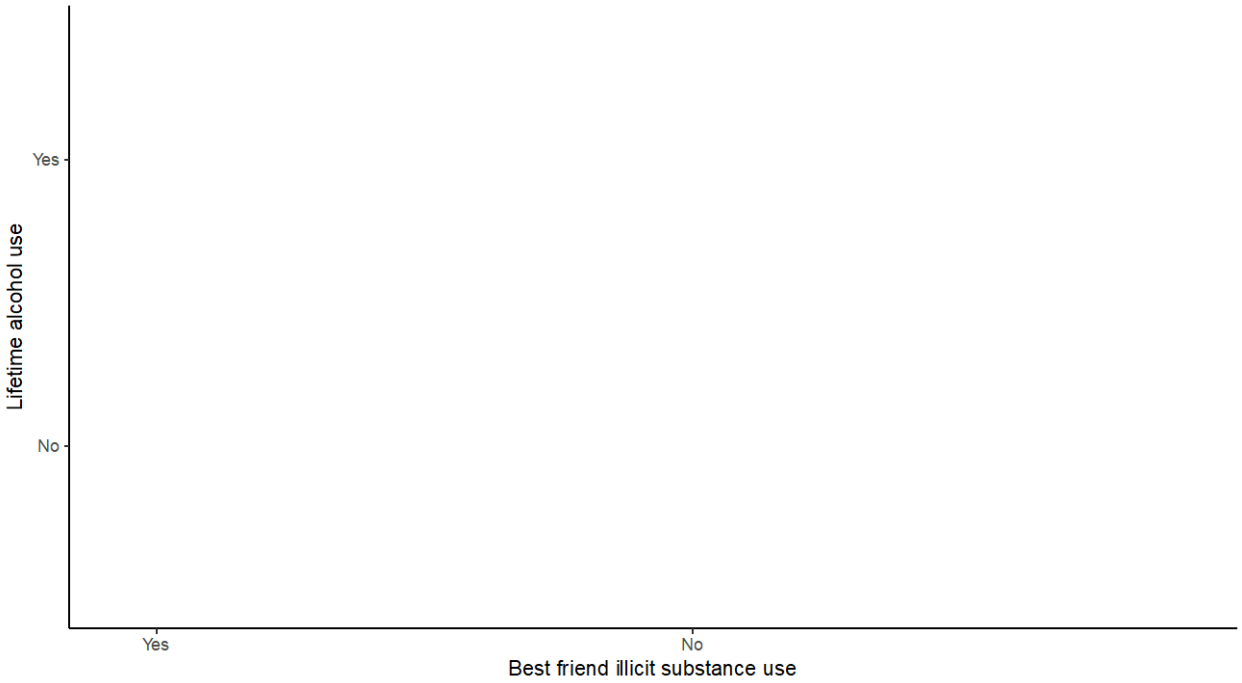

Figure S1. Visual cross tabulation of lifetime alcohol use and best friend illicit drug use items.

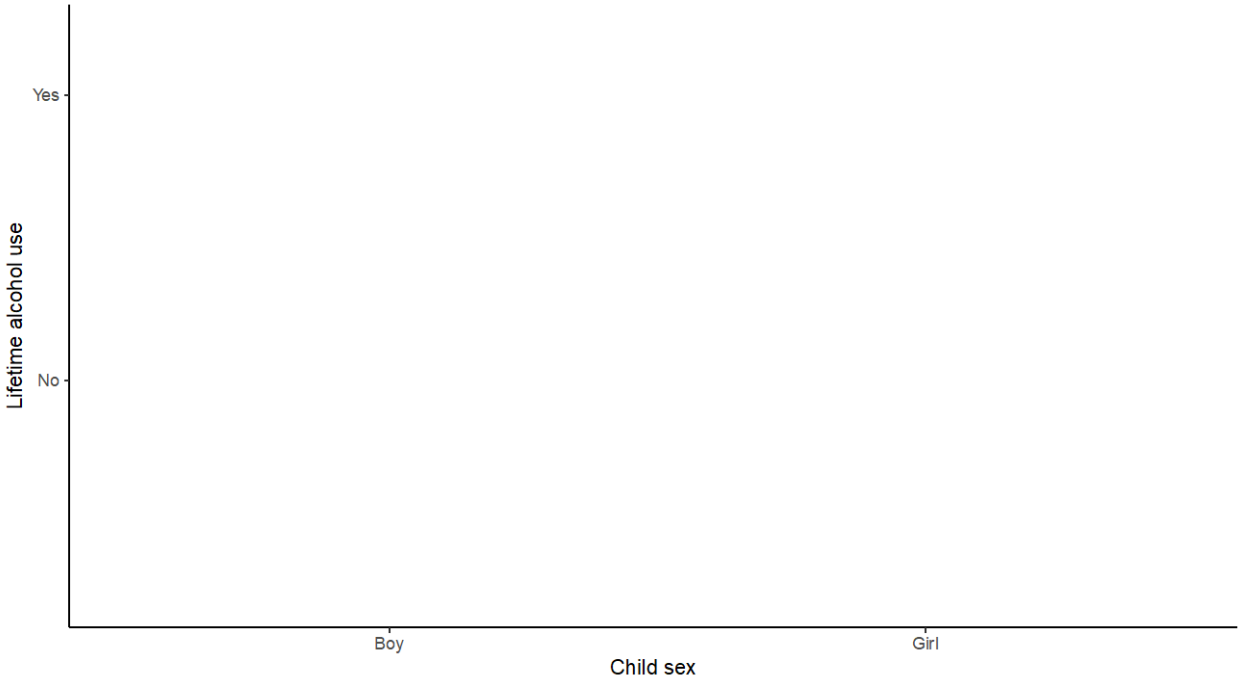

Figure S2. Visual cross tabulation of lifetime alcohol use and child sex items.

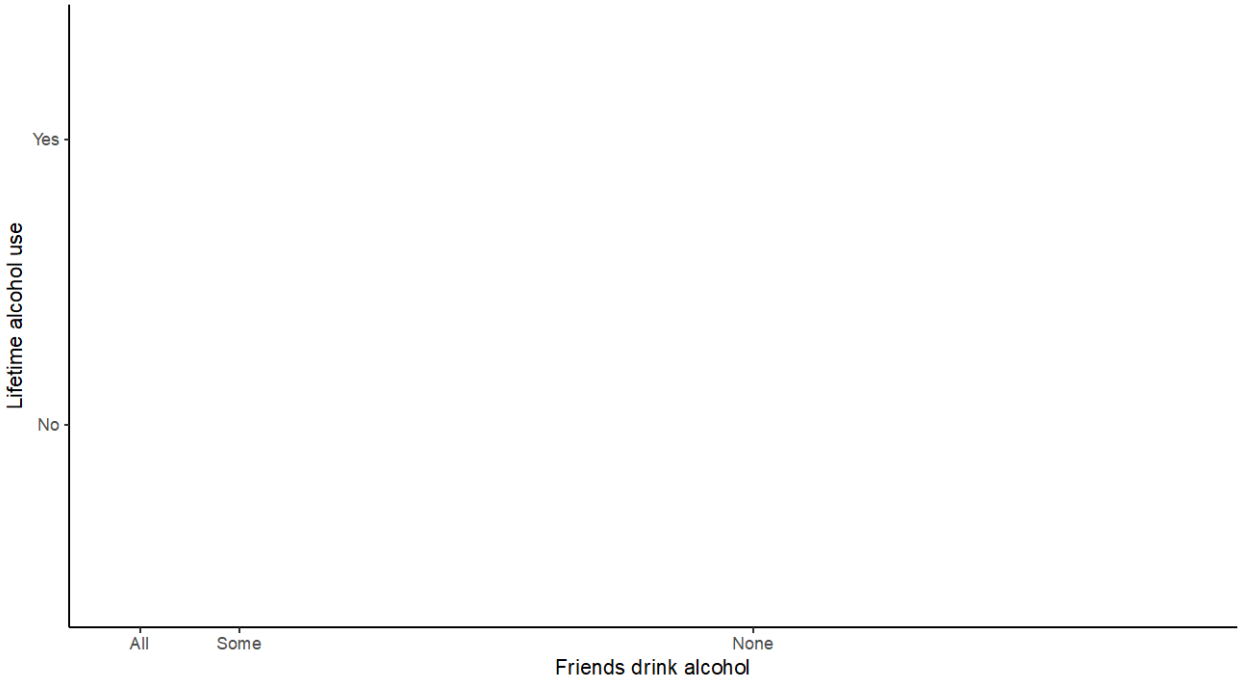

Figure S3. Visual cross tabulation of lifetime alcohol use and friends drink alcohol items.

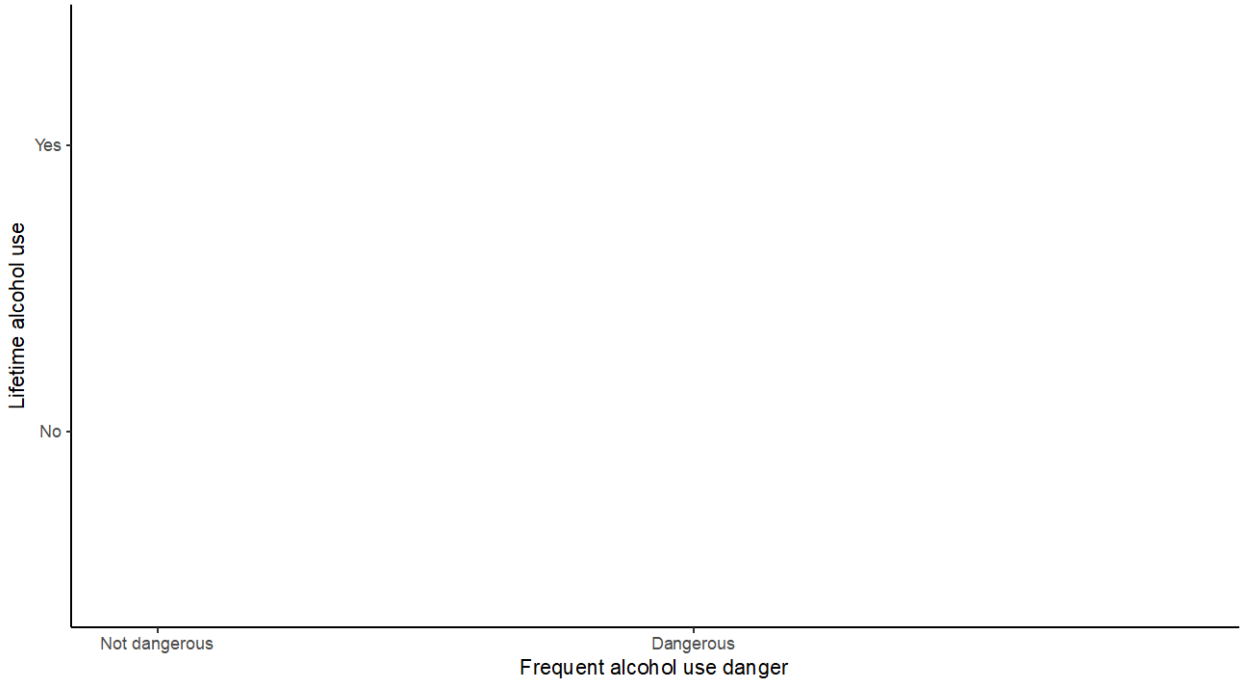

Figure S4. Visual cross tabulation of lifetime alcohol use and frequent alcohol use danger items.

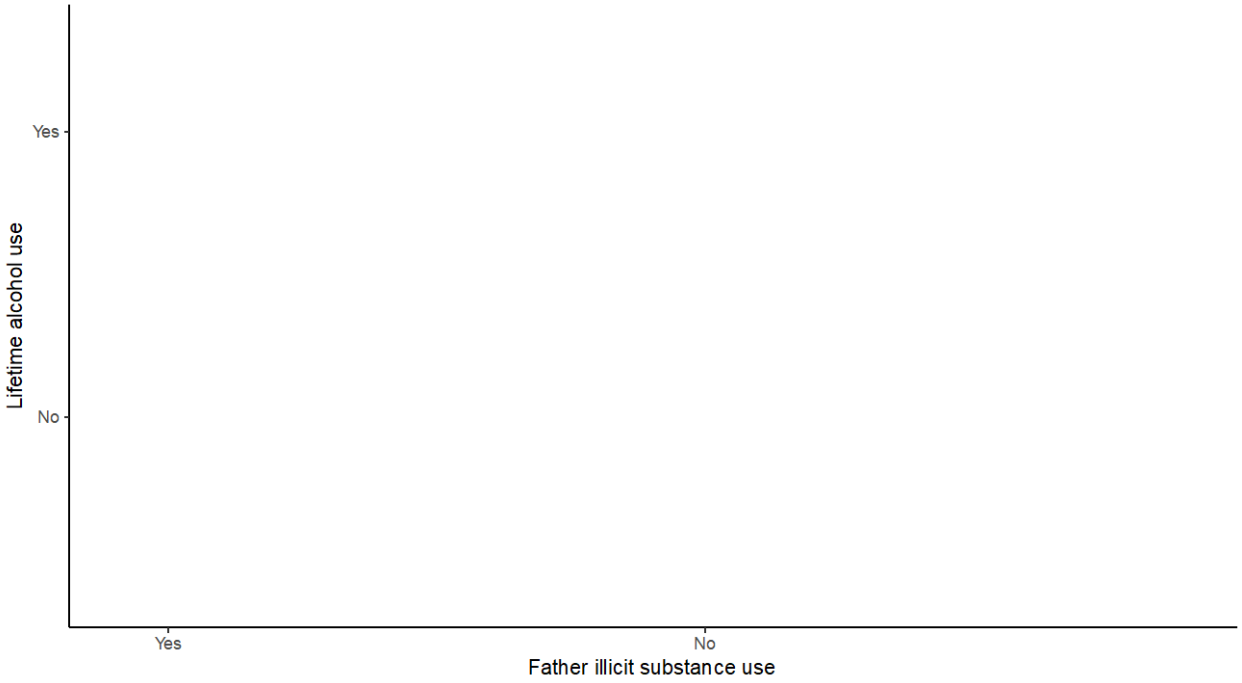

Figure S5. Visual cross tabulation of lifetime alcohol use and father illicit substance use items.

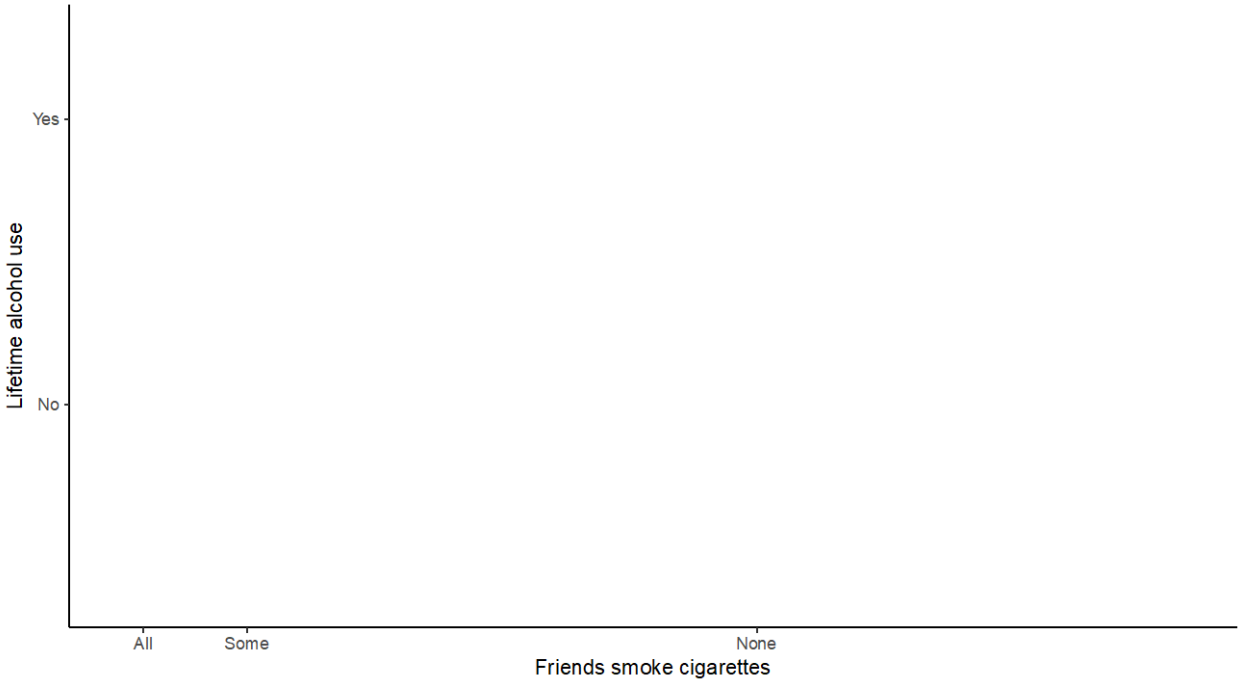

Figure S6. Visual cross tabulation of lifetime alcohol use and friend cigarette use items.

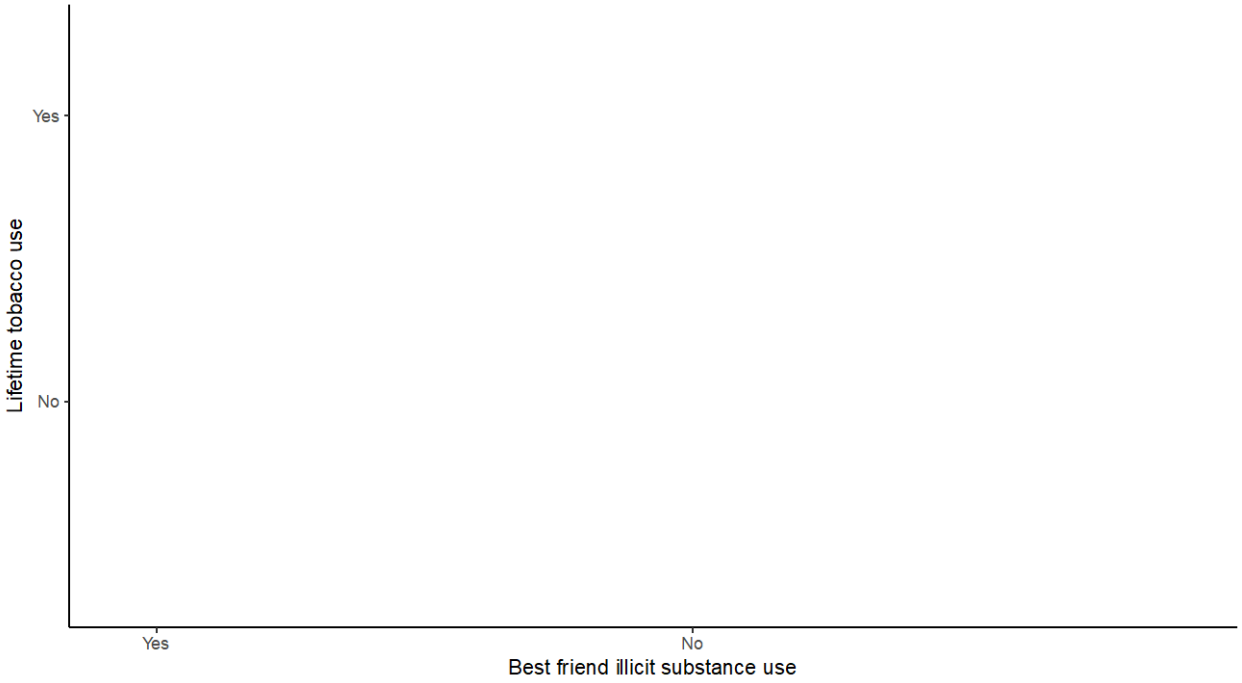

Figure S7. Visual cross tabulation of lifetime tobacco use and best friend illicit substance use items.

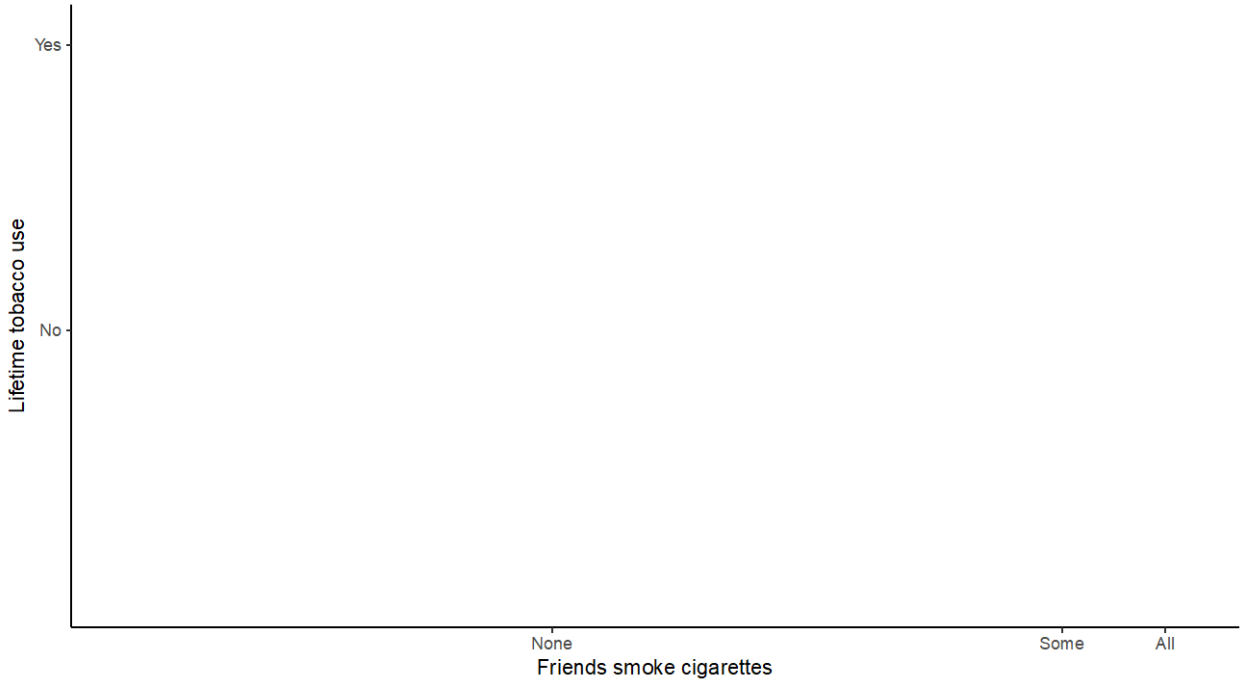

Figure S8. Visual cross tabulation of lifetime tobacco use and friend cigarette use items.

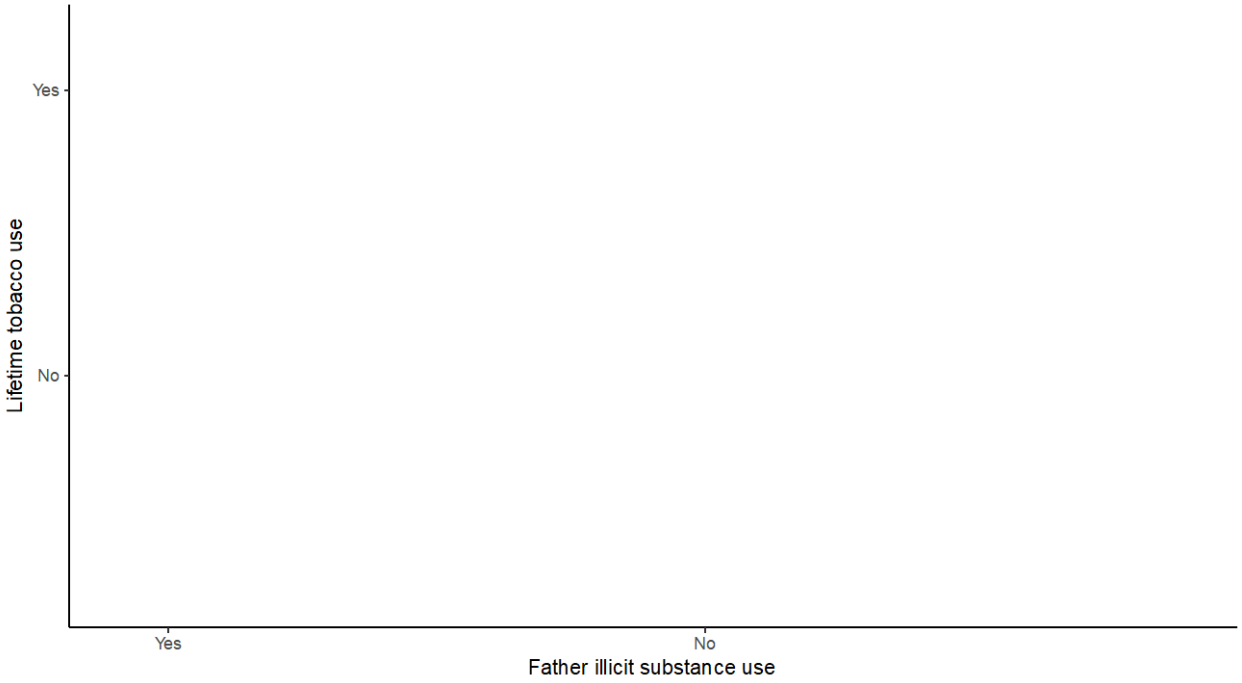

Figure S9. Visual cross tabulation of lifetime tobacco use and father illicit substance use.

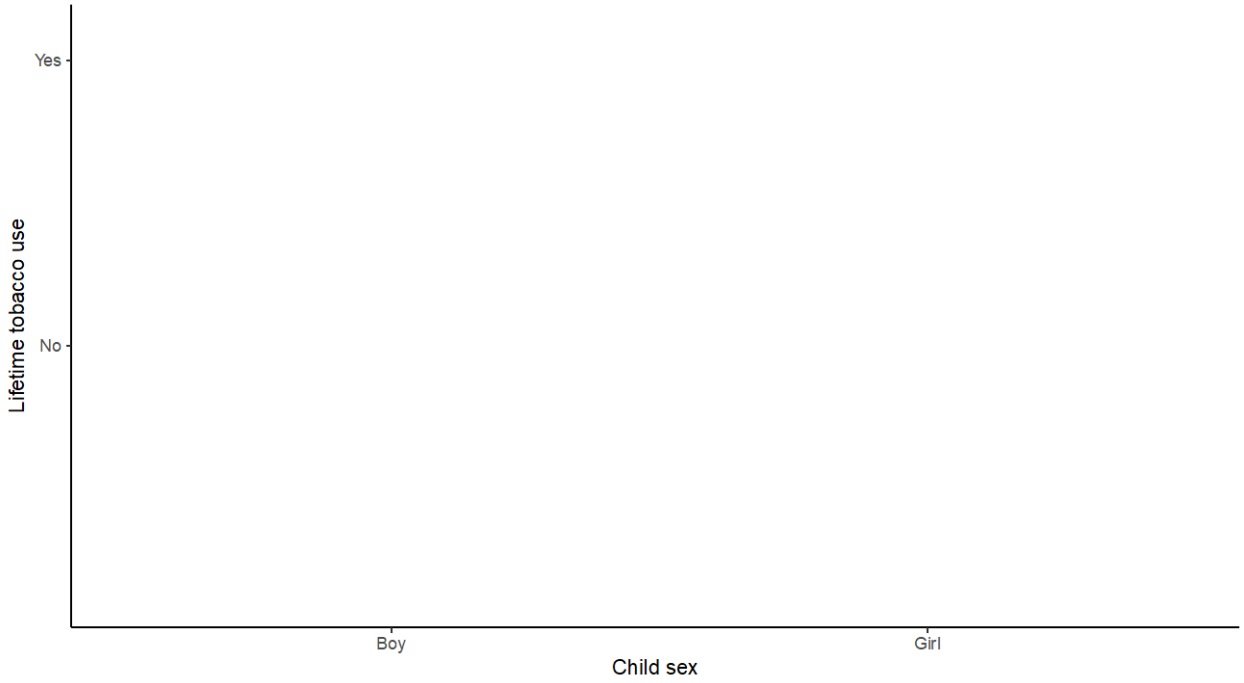

Figure S10. Visual cross tabulation of lifetime tobacco use and child sex items.

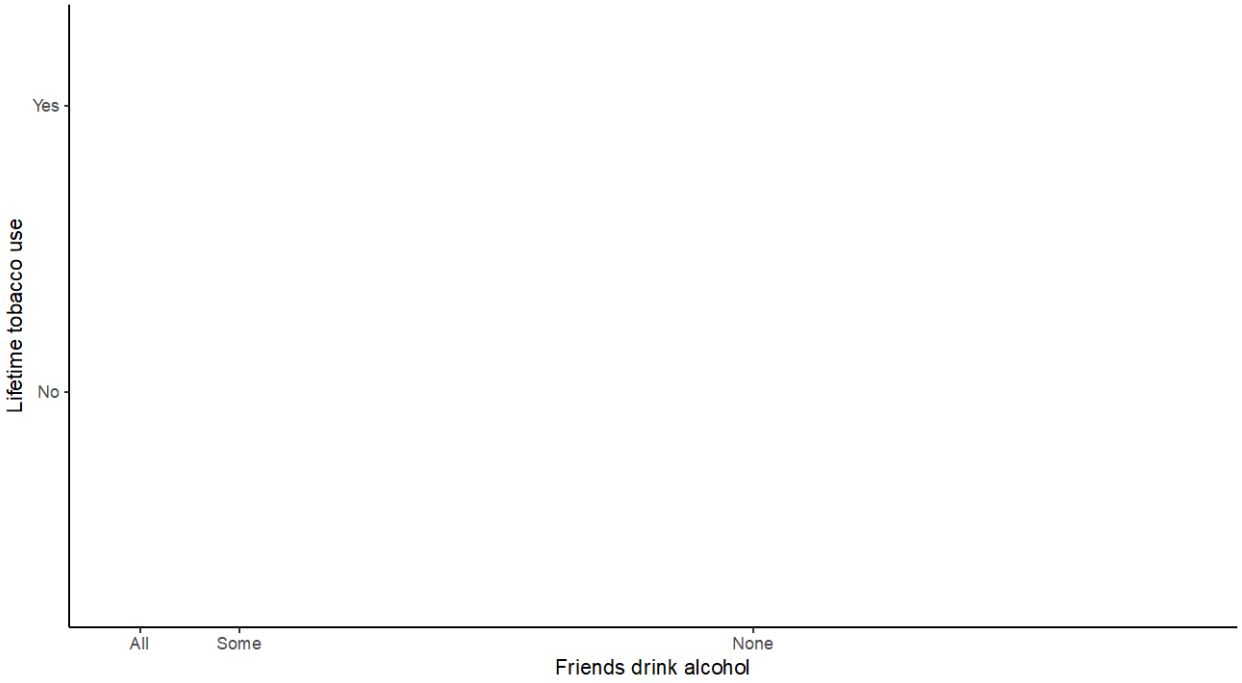

Figure S11. Visual cross tabulation of lifetime tobacco use and friends drink alcohol items.

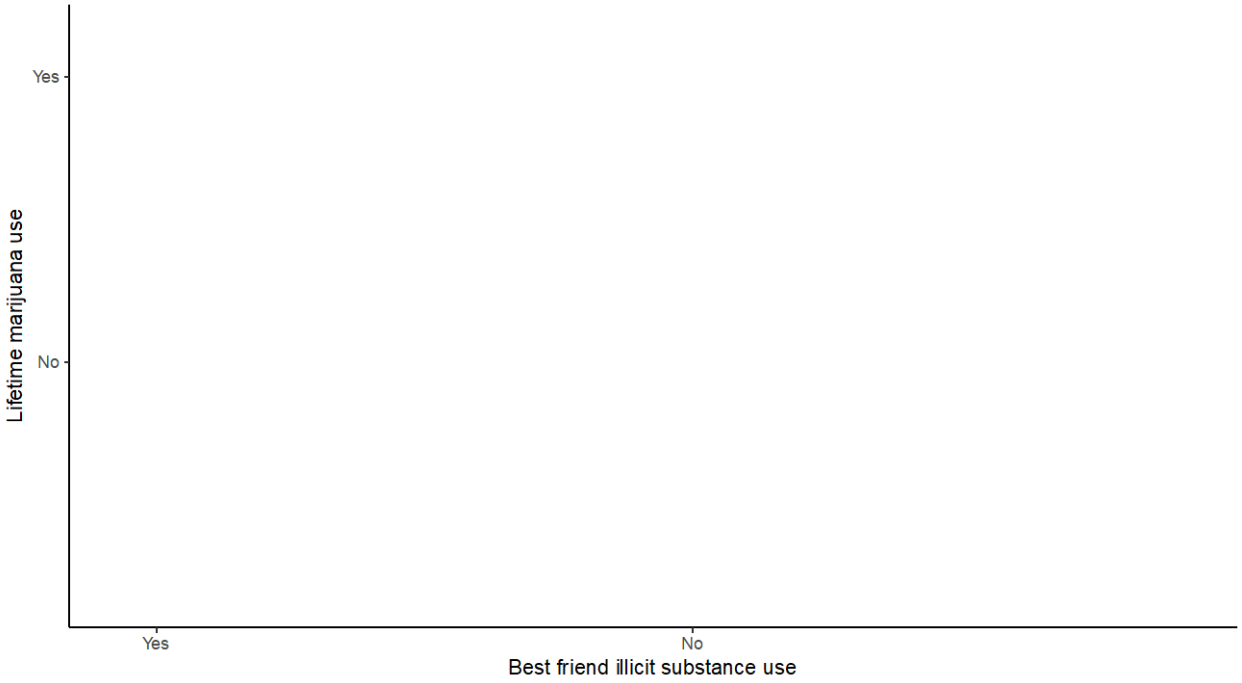

Figure S12. Visual cross tabulation of lifetime marijuana use and best friend illicit substance use items.

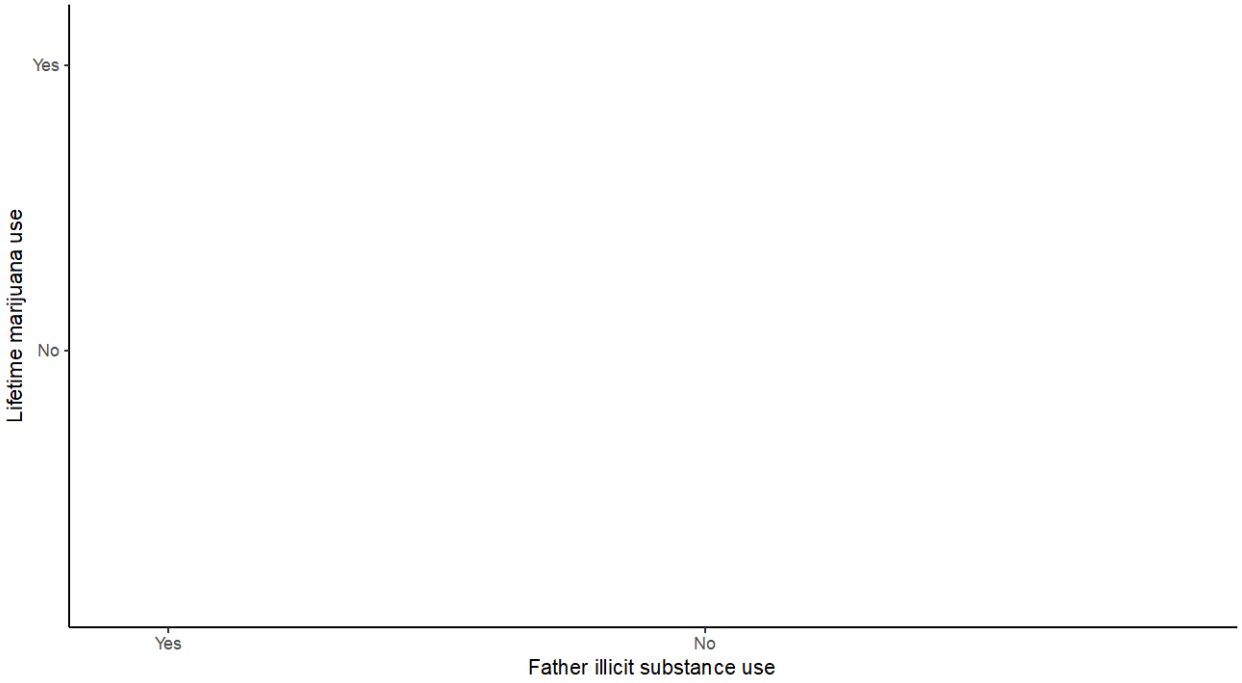

Figure S13. Visual cross tabulation of lifetime marijuana use and father illicit substance use items.

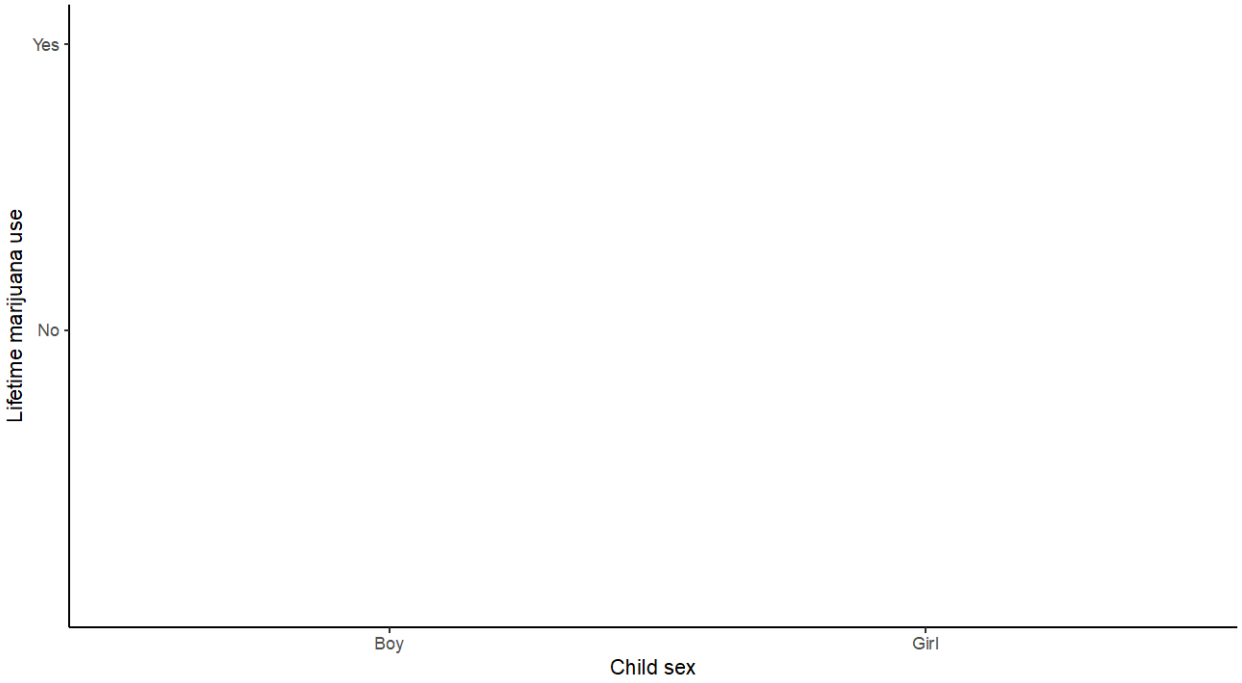

Figure S14. Visual cross tabulation of lifetime marijuana use and child sex items.

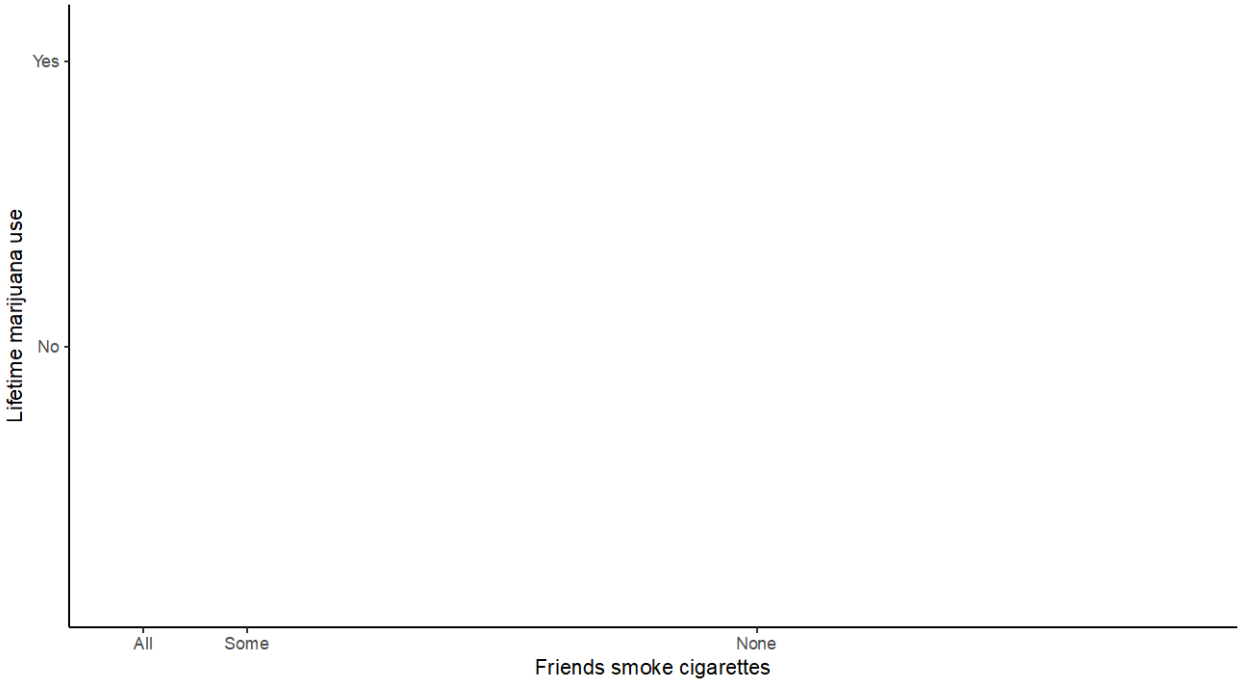

Figure S15. Visual cross tabulation of lifetime marijuana use and friend cigarette use items.

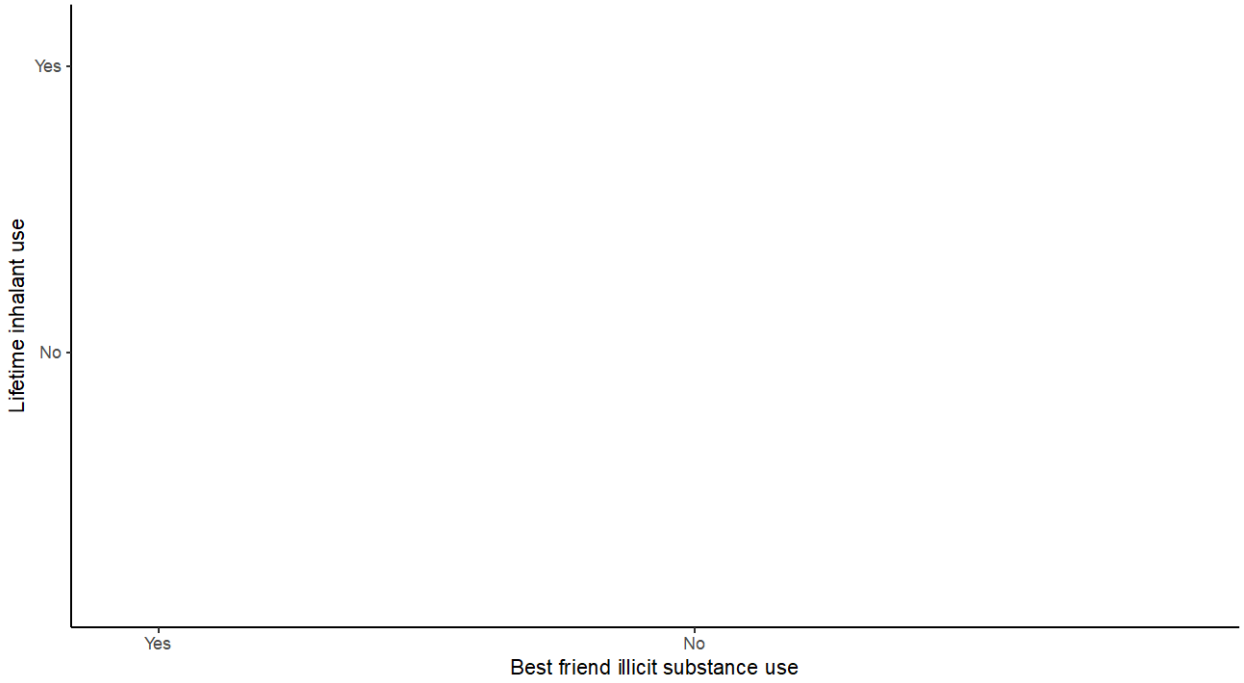

Figure S16. Visual cross tabulation of lifetime inhalant use and best friend illicit substance use items.

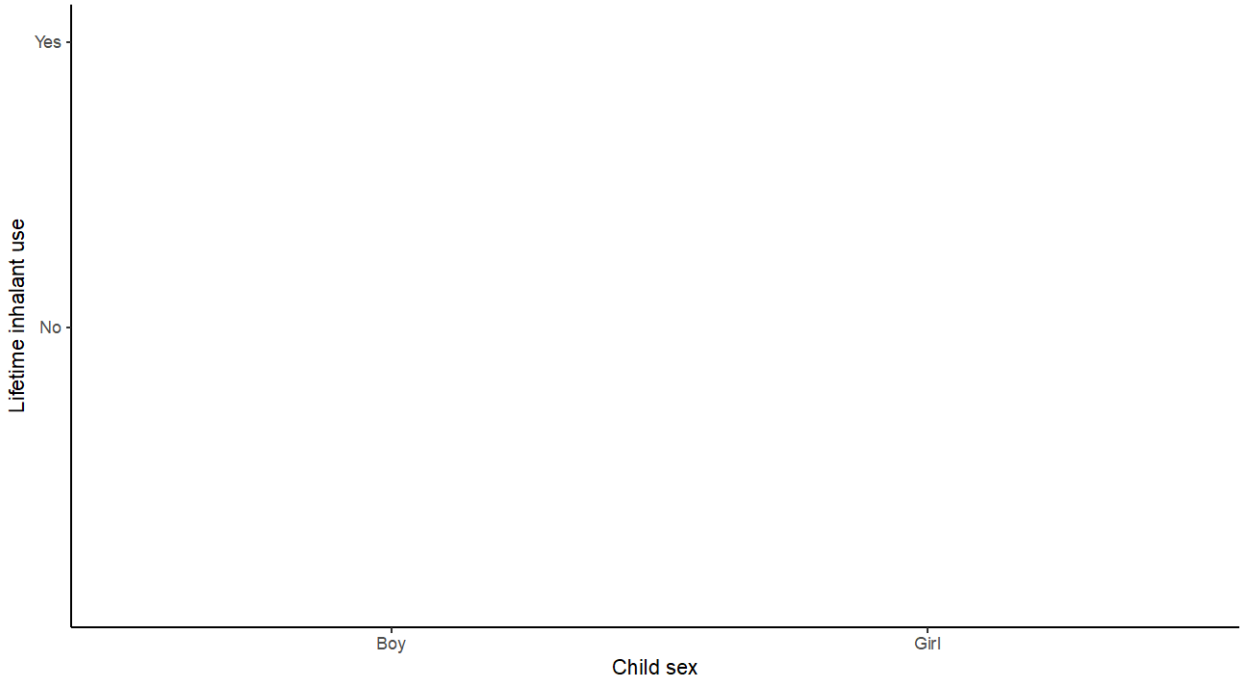

Figure S17. Visual cross tabulation of lifetime inhalant use and child sex items.

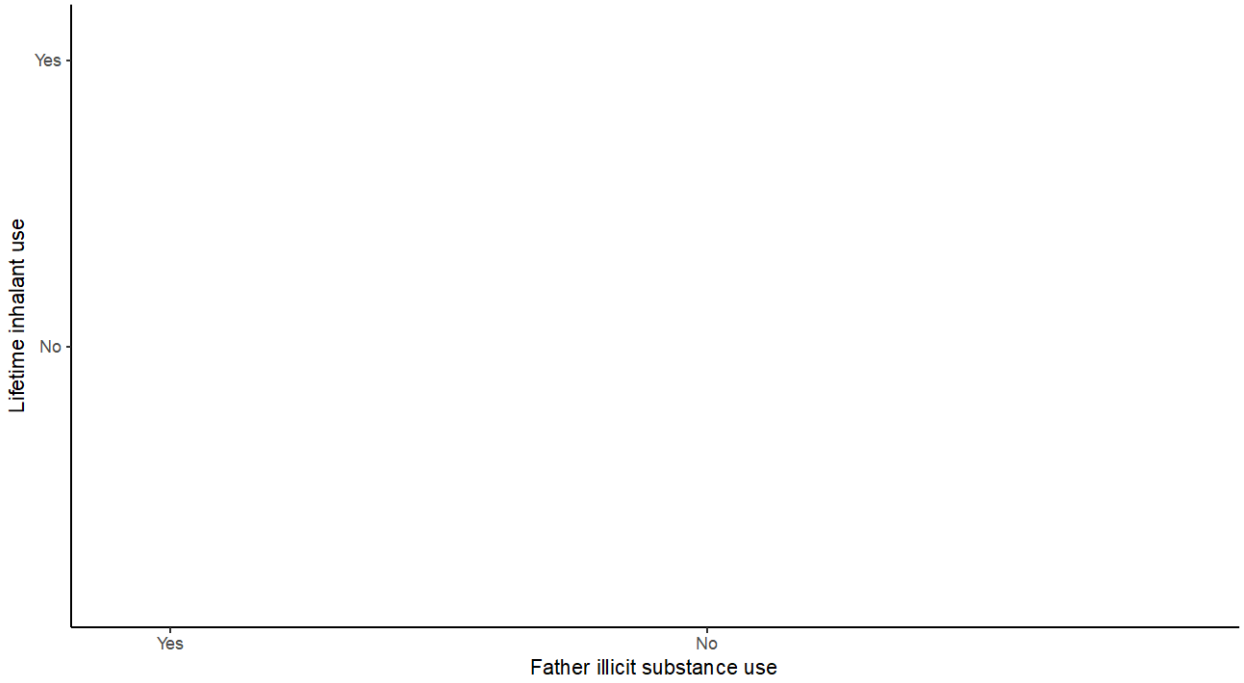

Figure S18. Visual cross tabulation of lifetime inhalant use and father illicit substance use items.

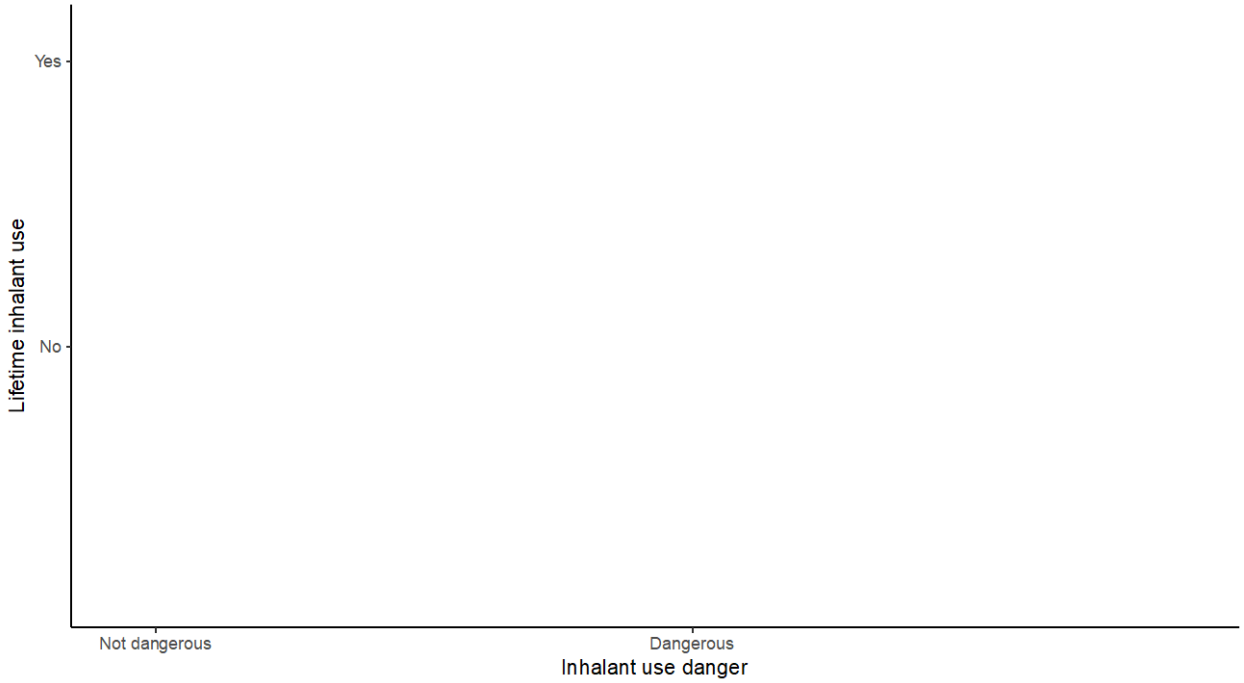

Figure S19. Visual cross tabulation of lifetime inhalant use and inhalant use danger items.

Alejandro Luis Vázquez

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EDUCATION

Ph.D. 2017-Present — ***Utah State University**, Combined Clinical/Counseling Psychology, APA Accredited.* Advisor: Melanie Domenech Rodríguez, Ph.D.

M.S. 2016 — ***Florida International University (FIU)**, Mental Health Counseling, CACREP Accredited.* Advisor: Maureen Kenny, Ph.D.

B.A. 2012 — ***Florida International University**, Psychology, Cum Laude*

A.A. 2010 — ***Miami-Dade College**, Psychology*

PUBLICATIONS

10) **Vázquez, A. L.**, Domenech Rodríguez, M. M., Barrett, T. S., Schwartz, S. E., Amador Buenabad, N. G., Bustos Gamiño, M. N., Gutierrez López, M. L., & Villatoro Velazquez J. A. (2020, Online first). Innovative identification of substance use predictors: Machine learning in a national sample of Mexican children. *Prevention Science.* doi: 10.1007/s11121-020-01089-4

9) **Vázquez, A. L.**, Domenech Rodríguez, M. M., Amador Buenabad, N. G., Bustos Gamiño, M. N., Gutierrez López, M. L., & Villatoro Velazquez J. A. (2019). The influence of perceived parenting on substance initiation among Mexican children. *Addictive Behaviors, 97, 97-103.*

8) **Vázquez, A. L.**, Domenech Rodríguez, M. M., Schwartz, S. E., Amador Buenabad, N. G., Bustos Gamiño, M. N., Gutierrez López, M. L., & Villatoro Velazquez J. A. (2019). Early adolescent substance use in a national sample of Mexican youths: Demographic characteristics that predict use of alcohol, tobacco, and other drugs. *Journal of Latinx Psychology. 7*, 273–283

7) **Vázquez, A. L.**, & Villodas, M. T. (2018). Racial/ethnic differences in caregivers' perceptions of adolescent and family support services need and utilization. *Cultural Diversity and Ethnic Minority Psychology, 25*, 323-330.

6) Domenech Rodríguez, M. M., Baumann, A., **Vázquez, A. L.**, Amador Buenabad, N. G., Franceschi Rivera, N., Ortiz Nolasco, N., & Parra-Cardona, J. R. (2018).

Scaling out evidence-based interventions outside the US mainland: Social justice or Trojan horse? *Journal of Latinx Psychology*, *6*, 329-344.

5) **Vázquez, A. L.**, Sibley, M. H., & Campez, M. (2018). Measuring impairment when diagnosing adolescent ADHD: Differentiating problems due to ADHD versus other sources. *Psychiatry Research*, *264*, 407-411.

4) Call, A., Domenech Rodríguez, M. M., **Vázquez, A. L.**, & Corralejo, S. (2018). Predicting participation in dual language immersion using theory of planned behavior. *Bilingual Research Journal*, *41*, 23-36.

3) Kenny, M. C., **Vázquez, A. L**., Long, H., & Thompson, D. (2017). Implementation and program evaluation of trauma-informed care training across state child advocacy centers: An exploratory study. *Children and Youth Services Review, 73*, 15–23

BOOK CHAPTERS

2) Kenny, M. C., Wurtele, S. K., & **Vázquez, A. L.** (2020). Sexual abuse and trafficking. In Stephen Hupp & Jeremy Jewell (Eds.)*, The Encyclopedia of Child and Adolescent Development.* New York; John Wiley. *(pp. 1-12).* New York: John Wiley. doi: 10.1002/9781119171492

1) Kenny, M. C., & **Vázquez, A. L.** (2017). Piers-Harris children's self-concept scale. In Virgil Zeigler-Hill & Todd Shackelford (Eds.), *Encyclopedia of Personality and Individual Differences.* Switzerland; Springer International. doi: 10.1007/978-3-319-28099-8_61-1

MANUSCRIPTS UNDER PEER REVIEW

2) Sollenberger, N., Mattfeld, A., Pettit, J., Kimbler, A., Patriarca, G., Hayes, T., **Vázquez, A.L.**, Shumway, P., Rey, Y., & McMakin, D. (2019). Sleep-related emotional adaptation is weakened by anxiety symptoms in peri-pubertal youth. Manuscript submitted for publication to *Journal of Child Psychology and Psychiatry*.

1) Garcia, B. H., **Vázquez, A. L.**, Moses, J. O., Cromer, K. D., Morrow, A. S., & Villodas, M. T. (2019). Risk and protective factors for substance use differ between high-risk youth with and without ADHD. Manuscript submitted for publication to *Child Abuse and Neglect*.

MANUSCRIPTS IN PREPARATION

5) Alvarez, M. C., Garcia, B. H., Navarro, C., Lara, J., **Vázquez, A. L**., & Domenech Rodríguez, M. M. (In preparation). Parent training interventions. In Rosalie

Corona & Bonnie Halpern-Felcher (Eds.), *Encyclopedia of Child and Adolescent Health.*

4) Baumann, A., **Vázquez, A.L.**, Carothers, B.J., Coelho, L., Juras, M., Kohlsdorf, M., Lima, A., Macchioni, A.C., & Ribeiro, M. (In preparation). Translation and validation of the evidence-based practice assessment survey to brazilian portuguese: Challenges and lessons learned.

3) **Vázquez, A. L.**, & Domenech Rodríguez, M. M. (In preparation). Machine learning algorithms: Terminators of mental health disparities or propagator of inequality?

2) **Vázquez, A. L.**, Chou, T., Navarro, C., Barrett, T. S., & Domenech Rodríguez, M. M. (In preparation). Understanding caregiver perceived need for and utilization of adolescent counseling services through machine learning.

1) **Vázquez, A. L.**, Garcia, B. H., Navarro, C., Barrett, T. S., & Domenech Rodríguez, M. M. (In preparation). An ecological examination of adolescent e-cigarette use: A machine learning approach to understanding a health epidemic.

CONFERENCE POSTERS AND PRESENTATIONS

21) Baumann, A., **Vázquez, A.L.**, Carothers, B.J., Coelho, L., Juras, M., Kohlsdorf, M., Lima, A., Macchioni, A.C., & Ribeiro, M. (2020, Februrary). *Translation and validation of the evidence-based practice assessment survey to brazilian portuguese: Challenges and lessons learned.* Poster presented at the Washington University Institute of Clinical and Translational Sciences Symposium and Poster Session, St. Louis, MO.

20) **Vázquez, A. L.**, Chou, T., Navarro, C., Barrett, T. S., Villodas, M. T., & Domenech Rodríguez, M. M. (2019, November). Understanding caregiver perceived need for and utilization of adolescent counseling services through machine learning. In M. D. Hetzel-Riggin (Chair). *Addressing violence, abuse, and trauma throughout the socioecological model.* Symposium presented at the Association for Behavioral and Cognitive Therapies, Atlanta, GA.

19) **Vázquez, A. L.**, Barrett, T. S., Domenech Rodríguez, M. M., Bustos, M., Gutierrez, M., Amador Buenabad, N. G., & Villatoro Velazquez J. A. (2019, March). *The influence of perceived parenting on substance initiation among Latinx children.* Poster presented at the Society for Research in Child Development, Baltimore, MD.

18) **Vázquez, A. L.**, Chou, T., Navarro, C., Barrett, T. S., & Domenech Rodríguez, M. M. (2019, March). *Examining caregiver perceived need for and utilization of adolescent counseling services through machine learning.* Poster presented at the Society for Research in Child Development, Baltimore, MD.

17) Baumann, A., **Vázquez, A. L.**, Macchioni, A. C., Ribeiro, M., Kohlsdorf, M., Juras, M. (2019, January). *Translation and validation of the Evidence-Based Practice*

Attitude Scale (EBPAS) to Brazilian Portuguese: Preliminary findings. Poster presented at the Washington University Institute of Clinical and Translational Sciences Symposium and Poster Session, St. Louis, MO.

16) **Vázquez, A. L**., Domenech Rodríguez, M. M., Schwartz, S. E., Amador Buenabad, N. G., Bustos, M., Gutierrez, M., & Villatoro Velazquez J. A. (2018, October). Demographic characteristics that predict substance use and intentions among elementary aged Mexican youth. In A. L. Vázquez (Chair). *Latinx substance use across borders: A discussion of early characteristics, academic impairment, and educational considerations.* Symposium presented at the biennial conference of the National Latina/o Psychological Association, La Jolla, CA.

15) **Vázquez, A. L**., Domenech Rodríguez, M. M., Schwartz, S. E., Amador Buenabad, N. G., Bustos, M., Gutierrez, M., & Villatoro Velazquez J. A. (2018, October). Individual and contextual factors associated with substance initiation in a national sample of Mexican children. In A. L. Vázquez (Chair). *Latinx substance use: Advanced methods for identifying factors associated with risk and resilience.* Symposium presented at the biennial conference of the National Latina/o Psychological Association, La Jolla, CA.

14) Corralejo, S. M., **Vázquez, A. L.,** & Domenech Rodríguez, M. M. (2018, October). *A New Look at Discipline in Puerto Rican Families.* Poster presented at the biennial conference of the National Latina/o Psychological Association, La Jolla, CA.

13) **Vázquez, A. L**., Domenech Rodríguez, M. M., Schwartz, S. E., Bustos, M. G., Gutierrez, M., Amador Buenabad, N., & Villatoro Velazquez J. A. (2018, April). *Early adolescent substance use in Mexico: Identifying individual and contextual risk factors through random forest analysis.* Poster presented at the Utah State University: Student Research Symposium, Logan, UT.

12) **Vázquez, A. L.,** Domenech Rodríguez, M. M., Schwartz, S. E., Bustos, M., Gutiérrez, M. L., Amador Buenabad, N. G., & Villatoro Velázquez, J. A. (2017, November). *Early adolescent substance initiation and use in a national sample of Mexican youth.* Poster presented at the annual convention of the Association for Behavioral and Cognitive Therapies, San Diego, CA

11) Mattfeld, A. T., Pettit, J. W., **Vázquez, A. L**., Kimbler, A., Yeguez, C. E., & McMakin, D. L. (2017, November). *Neural and behavioral correlates of negative overgeneralization.* Poster presented at the Society for Neuroscience, Washington, DC.

10) **Vázquez, A. L.,** Villodas, M. T., & Garcia, B. (2017, April). *Racial/ethnic differences in caregivers' perceptions of adolescent mental health services need and utilization.* Poster presented at the Society for Research in Child Development, Austin, TX.

9) **Vázquez, A. L.**, & Sibley, M. H. (2017, February). *Differentiating ADHD-related vs. other impairment in adolescents with ADHD.* Poster presented at the Miami International Child & Adolescent Mental Health, Miami, FL.

8) Golik, A., Salem, H., Palmer, M., **Vázquez, A. L**., Ramos, G, & Comer, J. S. (2017, February). *Youth mental health in the aftermath of disasters and war in developing countries: A systematic review.* Poster presented at the Miami International Child & Adolescent Mental Health, Miami, FL.

7) **Vázquez, A. L.**, Kenny, M. C., Long, H., & Thompson, D. (2016, August). *Training child advocacy center workers on trauma informed care.* Poster presented at the American Psychological Association, Denver, CO.

6) Olson, S. A., Sibley, M. H., **Vázquez, A. L.**, Rodriguez, M. J., Jr., & Pelham, W. E., Jr. (2015, February). *Application of a school consultation model in secondary settings for graduate training.* Poster presented at the National Association of School Psychologists conference, Orlando, FL.

5) Campez, M., Sibley, M. H., Pelham, W. E., Jr., Olsen, S., Morley, C., Hidalgo-Gato, N., Byrne, A., **Vázquez, A. L**., Rodriguez, L.M., & Ballinger, C. (2013, November). *Effects of a summer treatment program for adolescents with ADHD on measures of cognition.* Poster presented at the annual meeting for the Association for Behavioral and Cognitive Therapies, Nashville, TN.

4) Sibley, M. H., Pelham, W.E., Rodriguez, L. M., Sanchez, F., Morely, C., Olson, S., Byrne, A., Hidalgo-Gato, N., & **Vázquez, A. L.** (2013, November). *Changes in the DSM-5 ADHD criteria: Implications for adolescent diagnosis.* Poster presented at the 47th Annual Meeting of the Association for Behavioral and Cognitive Therapies, Nashville, TN.

3) **Vázquez, A. L.,** & **Schwartz, B. L.** (2012, March). *The effects of differential levels of information and incentive on rates of tip-of-the-tongue states.* Poster presentation at Weber State University, National Conference on Undergraduate Research, Ogden, UT.

2) **Vázquez, A. L.**, & **Schwartz, B. L.** (2012, March). *Tip-of-the-tongue states: Metacognition of faces.* Poster presentation and talk presented at Florida International University: Advance Research and Creativity in Honors Conference, Miami, FL.

INVITED PRESENTATIONS

1) **Vázquez**, **A. L.**, Domenech Rodríguez, M. M., Barrett, T. S., Amador Buenabad, N. G., & Villatoro Velazquez J. A. (2018, September). Factores de crianza que discriminan entre los niños que usan sustancias y los que abstienen. In M. M. Domenech Rodríguez (Chair). *Crianza positiva y consumo de drogas: hallazgos,*

modelos y retos para la implementación. Symposium presented at the 2o Congreso Mundial de Prevención de Adicciones en Niños y Adolescentes, Tijuana, BCS, MX.

FUNDING

Mental health service preferences among Latinx caregivers: A step towards culturally congruent intervention formats for children and adolescents.
American Psychological Foundation – Visionary Fund Grant
$4,305 award to examine mental health service utilization preferences for children and adolescents among Latinx families.
PI: Alejandro L. Vázquez
(2019)

NON-PEER REVIEWED MEASURES

1) Reeves, A. K., Joosten, M., Alvarez, M. C., **Vázquez, A.L.**, & Domenech Rodríguez, M. M. (2018). *Inclusive Demographics in Spanish.* Retrieved from osf.io/sbdqg

HONORS & AWARDS

Walter Borg Research Productivity Award and Scholarship
Utah State University: Psychology Department
Awarded $3,250 scholarship for excellent research productivity.
(2019)

Graduate Student Research Award
Utah State University - College of Education and Human Services
$2,880 award to purchase computational equipment to assist in completion of dissertation research.
(2018)

Psi Chi International Honors Society, Lifetime Membership
Awarded to top 15% of academic class
Lifetime membership (2011)

Florida International University - Honors College
(2011 – 2012)

Dean's List
Earning a 3.5 or higher cumulative GPA based on at least 9 credits per semester
(Spring 2011 and 2012)

PROFESSIONAL MEMBERSHIPS

American Psychological Association (APA) - Division 50: Society of Addiction Psychology
(2018-Present)

American Psychological Association (APA) - Division 53: Society of Clinical Child and Adolescent Psychology
(2018-Present)

National Latinx Psychological Association (NLPA)
(2018-Present)

Society for Research in Child Development (SRCD)
(2016-Present)

PROFESSIONAL SERVICE

Student Representative
Combined Clinical/Counseling Psychology Program
Utah State University
(2019-Present)

PROFESSIONAL & RESEARCH EXPERIENCES

Institutional Review Board (IRB)
USU, Logan, UT (February 2019-Present)
Supervisor: Nicole Vouvalis, J.D.
Position: Graduate Assistant

- Review request for Non-Human Subject Determinations
- Perform academic review of research protocols
- Manage and report data regarding IRB performance
- Generate best practice documents for a variety of research activities

Research Exploring Motivational and Emotional Development in Youth (REMEDY) Group
FIU, Center for Children and Families, Miami, FL (August 2016-August 2017)
Principal Investigators: Dana McMakin, Ph.D.
Position: Research Coordinator

- Managed a clinical trial that compared existing and novel strategies for enhance reward processing (i.e., behavior activation, savoring) to an active control (i.e., cognitive therapy) to examine impact on subjective, behavioral and neurobiological outcomes among youth with depression
- Managed a MRI based research study examine the role of sleep and rumination on the overgeneralization of negative memories among adolescents with anxiety.
- Conducted standardized clinical assessments with adolescents and their primary caregiver

- Preformed practice session with cognitive lab task in mock Functional Magnetic Resonance Imaging (fMRI) scanner
- Administered E-Prime/PsychoPy cognitive lab task with participants in fMRI scanner
- Monitored fidelity of data gathered by clinicians and staff
- Assisted in the development and completion of an RO1 grant submission

Summer Preparatory Program
*FIU, Center for Children and Families, Miami, FL (*August 2012 – May 2016)
Funding: Institute of Education Sciences Grant
Principal Investigators: Margaret Sibley Ph.D. and William E. Pelham, Ph.D.
Position: Program Assistant

- Recruited participants
- Acted as an interpreter and translated various texts (e.g., scales, letters to families, manuals) for Spanish speaking families
- Administered diagnostic and intellectual assessments for adolescents ages 10-16 in clinical, home, and school settings
- Maintained contact with participants through phone calls, emails, mail, and home visits to reduce drop out
- Worked with faculty and administrators in Miami-Dade schools to collect improvement ratings from teachers
- Facilitated weekly skills group for adolescents to improve time management, organization, and planning skills
- Assisted with implementation and treatment fidelity of summer camp based academic skills interventions for adolescents with ADHD (June – August 2013, 2014, 2015).

Noven Pharmaceutical ADHD Patch Trail
FIU, Center for Children and Families, Miami, FL (December 2012)
Principal Investigator: James Waxmonsky, MD
Position: Research Assistant

- Assisted with medication trial for a transdermal patch to treat ADHD symptoms in children and adolescents
- Supervised participants during three twelve-hour sessions
- Administered medication to participants
- Tracked overall participant response to the medication

Advanced Research and Creativity in Honors (*ARCH*) *program*
FIU, Honors College, Miami, FL (August 2011 – April 2012)
Honors Thesis: Tip-of-the-tongue states: Metacognition of faces
Principal Investigators: Alejandro Vázquez and Bennett Schwartz, Ph.D

- Independently designed and implemented a repeated measures study to examine the effects of varying amounts of information on recall and tip-of-the-tongue-states
- Completed IRB approval procedures

- Recruited participants and administered protocol on a computerized cognitive task
- Analyzed data using SPSS
- Presented data at university conference and national undergraduate conference

Saturday Treatment Program (Sat-TP)
FIU, Center for Children and Families, Miami, FL (August 2011 – April 2012)
Study: Developing social skills in children with ADHD
Principle Investigators: Erika Coles, Ph.D. and Kristine Kent, M.A.
Position: Undergraduate Counselor

- Led weekly social skills building treatment program for children with ADHD
- Taught recreational and athletic activities
- Utilized behavioral rewards system
- Mentored undergraduate counselors
- Completed longitudinal assessment of children's social behavior throughout the program

Callous-Unemotional Traits Lab
FIU, Center for Children and Families, Miami, FL (August 2011 –August 2012)
Study: Modified rewards and punishment study
Principal Investigators: Daniel Waschbusch, Ph.D.
Position: Undergraduate Research Assistant

- Coded videos of parent-child interactions using Dyadic Parent-Child Interaction Coding System (DPICS)
- Supervised and trained undergraduate research assistants in data management
- Led weekly meetings with research assistants and assigned responsibilities

Industrial Organizational Psychology Lab
Florida International University, Miami, FL (January 2011– April 2011)
Study: The effects of social networks on mitigating stress in Hispanic populations
Principal Investigator: Jesse Michel, Ph.D.
Position: Undergraduate Research Assistant

- Recruited participants from a university sample
- Administered and scored questionnaires
- Preformed data management
- Translated Spanish versions of surveys

TEACHING EXPERIENCE

2019 Spring — **Teaching Assistant, Research Design and Analysis I (EDUC/PSY 6600)**
Utah State University, Logan, UT
Assisted with a graduate level course seeking introduce students to research methodology and statistics. Responsibilities: Grade assignments and provide feedback on statistical output interpretations and R script. Supervision: Tyson Barrett, PhD.

2019 Spring **Teaching Assistant, Research Design and Analysis II (EDUC/PSY 7610)**
Utah State University, Logan, UT
Assisted with a graduate level course seeking to equip students with methodological and statistical knowledge necessary to conduct several forms of regression (e.g., multiple, variable selection, logistic, poisson). Responsibilities: Grade assignments and provide feedback on statistical output interpretations and R script. Supervision: Sarfaraz Serang, PhD.

2018 Fall **Instructor, Behavior Assessment and Intervention I (PSY 3720)**
Utah State University, Logan, UT
Taught an upper level undergraduate course focusing on implementation of applied behavior analysis in different setting and populations.

2018 Summer **Teaching Assistant, Analysis of Behavior: Advanced (PSY 3400)**
Utah State University, Logan, UT
Assisted in the development of an applied behavior analysis course by creating presentation (i.e., PowerPoint, videos) and testing materials.
Supervisor: Amy Odum, Ph.D.

2018 Spring **Teaching Assistant, Intellectual Assessment (PSY 6310)**
Utah State University, Logan, UT
Graduate level course training students in the administration of the Wechsler intelligence scale (i.e., WPPSI-IV, WISC-V, WAIS-IV). Responsibilities: Teaching the administration/scoring of intelligence scales and ensure standardization of administration in weekly labs.
Supervisor: Marietta Veeder, Ph.D.

2017 Fall **Teaching Assistant, Psychology of Gender (PSY 4230)**
Utah State University, Logan, UT
Undergraduate level course focusing on gender and racial/ethnic considerations in psychological research/practice. Responsibilities: Grading assignments, creating test questions, and participating in weekly class/online discussions.
Supervisor: Katherine Sperry, Ph.D.

CLINICAL EXPERIENCE

Box Elder School District
Box Elder High School, Brigham City, UT (August 2019-Present)
Supervisors: Marietta Veeder Ph.D.
Position: Practicum Intern

- Conducting therapy in high school setting for a variety of disorders (e.g., anxiety, depression, conduct disorder).
- Administered and interpret cognitive, academic, and behavioral assessments.

Counseling and Psychological Services (CAPS)
Utah State University, Logan, UT (August 2018-May 2019)
Supervisors: Monique Frazier Ph.D. and Amy Kleiner Ph.D.
Position: Practicum Intern

- 109 direct hours conducted therapy in a university counseling center serving students (i.e., ages 18+).
- Developed therapeutic skills to address a variety of mental health disorders among adolescents and emerging adults (e.g., anxiety, depression, eating disorder).

Center for Persons with Disabilities (CPD)
Utah State University, Logan, UT (August 2017-May 2018)
Supervisor: Martin Toohill, Ph.D.
Position: Graduate Assistant

- 56 direct assessment hours in an interdisciplinary university clinic specializing in ADHD and ASD diagnoses.
- Administered cognitive (i.e., WPPSI-IV, WISC-V, WAIS-IV) and achievement (i.e., KTEA-3) instruments with children, adolescents, and adults (i.e., ages 4+)
- Scoring/interpreting cognitive/achievement test and brief questioners
- Interdisciplinary assessment report writing experience

Psychology Community Clinic
Utah State University, Logan, UT (August 2017-August 2018)
Supervisor: Scott DeBerard Ph.D. and Sara Boghosian, Ph.D.
Position: Practicum Intern

- 123 direct hours in a university-based clinic serving individuals with a wide range of presenting problems (i.e., depression, anxiety, stress, explosiveness).
- Conducted clinical intakes, psychosocial assessments, and individual therapy with children, adolescents, and adults.
- Preformed documentation and assessment report writing.

Outpatient Service Unit (OPSU) and Crisis Stabilization Unit (CSU)
Masters Internship
Banyan Health Systems, Miami, FL (May-August 2016)
Supervisor: Bosco Lorio, Psy.D., LMHC
Position: Counseling Intern

- 260 direct clinical hours in a community setting working with clients (i.e., age 18+) in both inpatient and outpatient settings
- Outpatient
    - Treated predominantly low-income Hispanic/Latino clients who lack accessibility to insurance

    - Implemented solution focused and strength-based approaches with clients in Spanish
    - Co-facilitated substance abuse recovery groups
    - Preformed case management and documentation
    - Created treatment plans
    - Connected clients with community resources
- Inpatient
    - Treated multicultural population in a crisis stabilization setting
    - Conducted admissions, treatment planning, and discharged clients.
    - Worked with patients both individually and in groups to develop coping skills to reduce life stressors
    - Preformed case management and documentation
    - Connected patients with community resources such as shelters, inpatient substance abuse rehabilitation, and courts
    - Worked with the Mobile Crisis Team (MCT) to assess and intervene in cases of potential harm to self and/or others in the community
    - Completed training in crisis de-escalation

Supporting Teens Academic Needs Daily (STAND)
Masters Practicum
FIU, Center for Children and Families, Miami, FL (January-May 2016)
Supervisor: Margaret Sibley, Ph.D.
Position: Counseling Intern

- 233 direct clinical hours in an outpatient setting providing counseling for adolescents (i.e., ages 10-16) with ADHD and their parents
- Implemented a manualized treatment program using Motivational Interviewing (MI) skills to improving teens time management, organization, planning skills, family communication, and home structure
- Treatment was carried out in both individual and group formats
- Counseled parents and adolescents in 1 hour manualized academic skills building interventions
- Assisted families in creating behavioral contracts and reward schedules
- Led a 2 hour weekly academic skills build group with adolescents and assisted with weekly parent training

Summer Treatment Program (STP)
FIU, Center for Children and Families, Miami, FL (June – August 2011, 2012)
Study: Modified Rewards and Punishment Study
Principal Investigator: Daniel Waschbusch, Ph.D.
Position: Undergraduate Counselor

- 360 direct clinical hour (per year) intensive outpatient treatment program for children (i.e., ages 8-12) with ADHD and elevated callous/unemotional traits
- Supervised 15 boys and girls
- Taught sports and other recreational activities
- Implemented behavior rewards system with varying levels of negative consequences and rewards

- Taught social skills and emotion regulation

CLINICAL TRAINING

- Parent Management Training
- Behavior Modification
- Cognitive Behavioral Therapy
- Motivational Interviewing

NEUROPSYCHOLOGICAL & ACHIEVEMENT TESTING EXPERIENCE

- Wechsler Preschool and Primary Scale of Intelligence, Fourth Edition (WPPSI-IV)
- Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V)
- Wechsler Adult Intelligence Scale, Fourth Edition (WAIS-IV)
- Wechsler Abbreviated Scale of Intelligence, Second Edition (WASI-II)
- Wechsler Individual Achievement Test, Third Edition (WIAT-III)
- Kaufman Test of Educational Achievement, Third Edition (KTEA-3)
- Delis-Kaplan Executive Function System (D-KEFS)
- Automated Working Memory Assessment (AWMA)

INSTRUMENT ADMINISTRATION, SCORING, AND INTERPRETATION

- Adult Behavior Checklist (ABCL)
- Adult Self-Report (ASR)
- Child Behavior Checklist (CBCL)
- Children's Depression Rating Scale-Revised (CDRS-R)
- Computerized Diagnostic Interview Schedule for Children (C-DISC)
- Conners Parent/Teacher Form, Third Edition (Conners-3)
- Disruptive Behavior Rating Scale (DBRS)
- Home/School Situation Questionnaire (HSQ/SSQ)
- Kiddie-Sads-Present and Lifetime Version (K-SADS-PL)
- Repetitive Behavior Scale-Revised (RBS-R)
- Revised Children's Manifest Anxiety Scale, Second Edition (RCMAS-2)
- Reynolds Adolescent Depression Scale, Second Edition (RDAS-2)
- Social Responsiveness Scale, Second Edition (SRS-2)
- Teach Report Form (TRF)
- Youth Self-Report (YSR)
- Vineland Adaptive Behavior Scale, Third Addition (Vineland-3)

DIVERSITY TRAINING

February 8, 2018 **Allies on Campus**
Utah State University, Logan, UT.

3-hour workshop to develop skills to provide support to all members of the LGBTQA community.

April 13, 2018 **Safe Passages**
Utah State University, Logan, UT.
3-hour workshop to develop knowledge, explore attitudes, and develop skills necessary to provide safe spaces for minority student seeking higher education.

COMMUNITY PRESENTATIONS & OUTREACH

April 20, 2019 **Feria de la Salud**
Logan Community Recreation Center, Logan, UT.
Administered anxiety and depression screeners at a community health fair (3-hours) for Latinx families. Families needing individual services were referred to local mental health resources.

December 1, 2018 **Feria de Educación**
Logan High School, Logan, UT.
Assisted with a 2-hour education fair seeking to promote and equip Latinx youth/families with the information necessary to pursue higher education.

November 17, 2018 **HackUSU**
Utah State University, Logan, UT.
Provided support and judged engineering students in a contest seeking to leverage advances in app design and machine learning to aid in the treatment of mental health problems.

November 8, 2018 **Regulación de las Emociones**
Centro de la Famila, Logan, UT.
Co-facilitated 2-hour workshop (in Spanish) teaching parents skills for improving child emotion regulation.

October 29, 2018 **Expectativas y Reglas Claras**
The Family Place, Logan, UT.
Co-facilitated 2-hour workshop (in Spanish) teaching parents communication skills to improve child compliance with commands.

April 28, 2018 **Feria de la Salud**
Logan Community Recreation Center, Logan, UT.
Administered anxiety and depression screeners at a community health fair (3-hours) for Latinx families. Families needing individual services were referred to local mental health resources.

February 16, 2018 **Frente Unido**
The Family Place, Logan, UT.
Co-facilitated 2-hour workshop (in Spanish) on utilizing a family based approach to address child/adolescent behavior problems.

February 9, 2018 **Comunicación de Parejas**
The Family Place, Logan, UT.
Co-facilitated 2-hour workshop (in Spanish) on skills for communicating effectively with spouses/partners.

ADDITIONAL EXPERIENCE

- Fluent in Spanish
- Training in R
- Training in high performance computing
- fMRI safety training
- Techniques for Aggression Management (TEAM)
- Practical knowledge of E-Prime and PsychoPy
- Practical knowledge of WordPress