Substance Use Among Mexican Adolescents

Moderators of Intervention Efficacy and Risk Profiles

by

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#### ABSTRACT

Adolescent substance use is a complex and significant public health concern that has received considerable attention among researchers and practitioners (Gray & Squeglia, 2018). The purpose of this dissertation was to examine factors associated with substance use intervention effects and to develop subgroups of risk factors for Mexican adolescents. This dissertation utilizes secondary data from a randomized controlled trial of the school-based substance use universal prevention program, keepin' it REAL (kiR). The dissertation included two studies. Study 1: This study tested a model on the efficacy of the school-based substance use universal prevention program, keepin' it REAL, among a sample of Mexican adolescents (N = 3,742, 11-17 years old). Study 1 analysis included Structural Equation Modeling and results demonstrated that participation in kiR positively predicted alcohol resistance strategies and those alcohol resistance strategies were negatively and significantly associated with alcohol use. Further, depressive symptomology was a moderator of intervention effects as the effects of kiR on resistance strategies increased as the level of depressive symptomology increased. Study 2: this study explored subgroups (classes) of Mexican adolescents (N = 5,520, 11-14 years old) based on their experiences with violence (witnessing, victimization, and perpetration), depressive symptomology, and substance use (alcohol, tobacco, and marijuana). Using Latent Class Analysis (LCA) four empirically, well-differentiated classes emerged representing adolescents various risk typologies (Moderate Risk-Violence at 55% of the sample, Low Risk at 35%, High Risk at ~8%; and Moderate Risk-Substance Use at ~2%) Implications for research and practice are discussed across both studies.

# DEDICATION

Para mi padre, Rogelio Antonio Arévalo Castro y mi madre, Ana Patricia Arévalo García, porque sin sus sacrificios este doctorado no hubiera sido posible.

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### CHAPTER 1

## INTRODUCTION

Substance use during adolescence poses a significant threat to the physical, emotional, and psychosocial health and wellbeing of youth. Adolescent substance use is associated with a variety of problems later in life, such as development of substance use and mental health disorders, poor physical health outcomes, interpersonal challenges, negative effects of educational and occupational outcomes, and increased mortality rates (Gray & Squeglia, 2018; Hale & Viner, 2012; Hernandez, Lavigne, Wood, & Wiers, 2015). To date, an extensive body of literature has explored and identified risk factors associated with adolescent substance use, including community disorganization, community violence, parent-child conflict, family drug attitudes and behaviors, early and persistent adolescent behavioral problems, academic failures, associations with deviant peers, and adolescent favorable attitudes and intentions of substance use (Chassin & DeLucia, 1996; Hawkins, Catalano, & Miller, 1992).

In response to adolescent substance use, its antecedents, and its consequences, researchers have focused on developing universal prevention efforts with the goal of stopping problematic behavior before it starts (Hawkins et al., 2015). Furthermore, with an ever-increasing globalized society, effective prevention programs developed in the United States are being adapted, implemented, and tested in international contexts. Overall, despite advances in prevention science and the push to promote effective prevention programs internationally, much remains unknown about factors that moderate intervention effects and how various factors may cluster together to predict adolescent risk profiles. The purpose of this dissertation is to investigate the effectiveness of a

school-based substance use prevention program and risk profiles of adolescents in Mexico.

### Substance Use Among Mexican Adolescents

Recent estimates suggest that alcohol, tobacco, and marijuana use rates among Mexican adolescents are on the rise (Reséndiz Escobar et al., 2018; Villatoro Velázquez et al., 2016). On average, between 53% and 59% of adolescents across Mexico have drunk alcohol at least once in their lifetime (Benjet, Borges, Méndez, Casanova, & Medina-Mora, 2014; Villatoro Velazquez et al., 2016). Furthermore, between 15-20% of the adolescents reported past-30 day binge drinking and 3% reported daily binge drinking (Reséndiz Escobar et al., 2018; Villatoro Velazquez et al., 2016). These figures illustrate that problematic alcohol use among Mexican adolescents is also elevated. Rates of alcohol use among Mexican adolescents increase with age and thus early age alcohol use initiation becomes a significant risk factor. For instance, one-in-three 12-year old adolescents (Benjet et al., 2014). In addition to alcohol, cigarette and marijuana is also present among Mexican adolescents.

Regarding cigarette and tobacco use, 30% of adolescents reported lifetime cigarette use, 11% reported past month use, and 7.4% reported daily use (Villatoro Velazquez et al., 2016). Lastly, though used at lower rates than alcohol and cigarettes, marijuana has been used more than any other drug and seen the sharpest increase in recent years with up to 11% of adolescents having reported lifetime marijuana use (Villatoro Velazquez et al., 2016). For example, from 1991 to 2014, excessive alcohol use rose from 9.5% to 14.5% but marijuana use rose from 1.5% to 10.6% (Villatoro

Velazquez et al., 2016). The rising rates of substance use among Mexican adolescents pose a threat to their well-being. As reported earlier, substance use can have detrimental effects on mental health and educational or occupational outcomes. To respond effectively to the issue of increased substance use, it is important to implement evidencebased adolescent substance use prevention programs. Furthermore, exploring the role of known risk factors for adolescent substance use (e.g., depressive symptomology and violence experiences) can help with more effective prevention efforts.

### **Depressive Symptomology and Adolescent Alcohol Use**

Depressive symptomology is a significant risk factor associated with substance use. For example, depressive symptoms predict alcohol use initiation (Brook, Whiteman, Gordon, Nomura, & Brook; 1986; Kaplow, Curran, Angold, & Costello, 2001; Wu et al., 2006) and subsequent alcohol use (Diego et al., 2003; Donovan, 2004) among diverse adolescent samples. Depressive symptomology also has been found to be positively associated with alcohol use severity among Latinx (Cano, de Dios, Castro, Vaughan, Castillo... & Molleda, 2015) and Mexican youth (Arévalo Avalos, Ayers, Marsiglia, Kulis, Nuño-Gutierrez...& Mendoza, 2019; Raffaelli et al., 2013). These data illustrate the interconnected relationship between alcohol use and depressive symptomology and without interventions these two risk factors can develop into more severe behavioral health disorders. For example, researchers have noted that adolescents who report a history of alcohol abuse are up to four times more likely to endorse history of major depressive disorder (MDD) as their counterparts who have not abused alcohol (Deykin, Levy, & Wells, 1987; Hernadez et al., 2015). It also appears that early alcohol use is associated with the onset of psychiatric disorders and adolescents with diagnosis an MDD report earlier problematic alcohol use (Deykin et al., 1987). The extant literature on this topic supports the notion that depression and alcohol use are highly comorbid conditions that have the potential for detrimental long-term health for Mexican adolescents.

## Violence Experiences as a Risk Factor for Adolescent Health

Violence experiences are associated with depressive symptomology and substance use. Specifically, exposure to interpersonal (e.g., bullying), family based (e.g., childhood physical abuse), and community based violence (e.g., assaults/robberies) are negatively associated with mental health, including depression (Buka, Stichick, Birdthistle, & Earls, 2001; Espelage & Holt, 2008; Espelage, Low, Rao, Hong, & Little, 2013; Ford, Elhai, Connor, & Frueh, 2010; Kilpatrick et al., 2003; Martinez & Richers, 1995) and with externalized problems, such as increased risk of alcohol or drug use and violence perpetration (Buka et al., 2001; Duke, Pettingell, McMorris, & Borowsky, 2010; Ford et al., 2010; Kilpatrick et al., 2003; Vermerein et al., 2003; Wright, Fagan, & Pinchevsky, 2013). Violence experiences may have a particularly salient role in Mexican adolescents' health and warrant further investigation.

Although an extensive review on the etiology of violence is beyond the scope of this dissertation, I briefly summarize the context of violence that may expose Mexican adolescents to increased risk for externalized and internalized problems. Data from the latest national survey on victimization and perceptions of safety among Mexican adults found that two out of three adults reported witnessing alcohol use around their neighborhood, one in two reported experiencing drug use and frequent assaults or robberies, and one in three indicated knowledge of drug sales, gang presence, and frequent shootings (Instituto Nacional de Estadística e Informática, INEGI, 2018). The results from this survey highlighted that from 2013 to 2018 the sale and consumption of drugs increased from 23.4% to 33.8% and 40.1% to 50.6%, respectively (INEGI, 2018). The presence of these community factors (drugs and related crime) may pose Mexican adolescents at increased risk for witnessing violence that has been associated with increased substance use (Arévalo Avalos et al., 2018).

Research also indicates that Mexican adolescents are experiencing victimization and violence perpetration; two phenomenon that are often interrelated. For example, according to Caballero, Ramos, González, & Saltijeral (2010) over half of the Mexican adolescents in their study reported a history of parental psychological and physical violence. Furthermore, research indicates that Mexican adolescents school drop out rates are associated with parental neglect, parental substance use, parental domestic violence, and parental criminal behaviors (Benjet et al., 2009). Regarding perpetration, from 2007 to 2010, homicide rates among adolescents in Mexico more than doubled – from 10% to 25.5% (World Bank, 2012) due to a variety of factors, including gangs and drug-related crime (Puyana et al., 2017). Collectively, for Mexican adolescents, this exposure to family-based violence and community-based violence has been linked to increased substance use (Arévalo Avalos et al., 2018) and increased depressive symptomology (Bauman & Summers, 2009). The pervasive nature of violence and the various contexts in which violence may be present for Mexican adolescents, highlight the importance of considering how multiple risk factors may manifest in their lives and how these factors may be related to substance use. Further, considering the role of multiple risk factors in prevention of substance use among Mexican adolescents may result in the development of more effective interventions.

### **Universal Prevention Programs and Intervention Effects**

As reported above, substance use, depressive symptomology, and violence experiences are interrelated phenomena that have the potential to negatively impact adolescent health. Stopping adolescents' behavioral problems before they develop would result in healthier youth and improve the chances these adolescents develop better longterm physical, emotional, interpersonal, and occupational outcomes. Universal prevention programs are focused on inhibiting the onset or progression of adolescent behavioral problems (e.g., alcohol use, depressive symptomology) by targeting all adolescents regardless of presenting problems or level of risk exposure (Hawkins et al., 2015). Over the last 40-years the field of prevention science has grown, resulting in the development and test of universal prevention interventions for issues such as alcohol, tobacco and other drug use, depression, and violence perpetration (for a complete review of effective preventive programs see Hawkins et al., 2015). In school contexts, substance use universal prevention programs may focus on raising alcohol, tobacco, and other drug use awareness (e.g., norms and attitudes), promoting the development of personal-self management and social skills, increasing motivation and skills to use drug resistance strategies, and/or promoting modeling and peer relationships (Botvin et al., 2001; Foxcroft & Tsertsvadze, 2011; Hetch et al., 2003). School-based universal prevention programs like Life Skills Training (LST), which teaches adolescents personal selfmanagement, social, and drug-resistance skills; and keepin' it REAL (kiR) which extends the LST model using culturally grounded narratives, have been found to produce desired effects in substance use prevention (Botvin 1980, 2001; Hetch et al., 2003).

Successful implementation of effective prevention programs across diverse contexts can help mitigate the negative effects of violence, depressive symptomology, and alcohol among adolescents.

Unfortunately, not all prevention efforts and interventions are effective. Foxcroft and Tsertsvadze, (2011) conducted a systematic review of 53 universal school-based prevention programs for adolescent and youth alcohol misuse and concluded that only 21 of the studies found statistically significant effects. Similarly, results from a metaanalysis of 28 school-based substance use programs suggested that intervention effects, if significant, are often small (Strøm, Adolfsen, Fossum, Kaiser, & Martinussen, 2014). It is unclear why some prevention programs work and others do not (Foxcroft & Tsertsvadze, 2011). In fact, there is a dearth of information regarding for whom and under what conditions interventions are effective (Borsari, 2013; Werch & Owen, 2002). Due to these knowledge gaps more research is needed that examines moderators of intervention efficacy (Hernandez et al., 2015). It is possible the results from these types of studies explain how adolescent's pre-intervention characteristics influence the effects of interventions. Such information can assist in intervention development and efficacy testing. Though the goal of universal prevention programs is to target all youth regardless of risk exposure, understanding these risk-exposure characteristics and how they interact with interventions may help the refinement of universal prevention programs.

## The Current Studies

As described earlier, depressive symptomology appears to be a significant risk factor for adolescent substance use. Yet, the role that depressive symptomology plays in universal prevention programs is unclear and warrants further investigation. Depressive

symptomology appears to moderate the effects of alcohol use interventions among college students (Geisnera, Varvil-Weld, Mittmann, Mallett, & Turrisi, 2015; Merrill, Reld, Carey, & Carey, 2014). In these studies, the interventions targeted college students already engaging in problematic drinking behaviors and with comorbid alcohol use/depressed mood (secondary prevention) and the effects were mostly observed at low levels of depressive symptomology (Geisneera et al., 2015; Merrill et al., 2014). The target populations in the studies reported above is markedly different than targets of universal prevention programs (i.e., age and setting: college age vs. middle school, type of intervention: brief cognitive behavioral interventions vs. long life skills training curriculum). Yet, if some moderation effects are found at this level of intervention, it is possible that among adolescents participating in universal prevention programs depressive symptomology would have some moderating effects as well. Depressive symptomology may moderate intervention effects because it places adolescents at increased odds and higher-risk for substance use. High-risk adolescents appear to benefit more from alcohol use interventions relative to their low-risk counterparts (Koning, Verdurmen, Engels, van den Eijnden, & Vollebergh, 2012). Collectively, this limited body of literature on risk and moderation effects suggests that depressive symptomology may help explain intervention effects. Thus, study 1 of this dissertation is focused on exploring whether depressive symptomology moderates the effects of kiR, a school-based substance use universal prevention program among Mexican adolescents.

If universal prevention interventions have differential effects according to the level of risk of adolescents; then, it may be helpful to identify risk-profiles of adolescents. Much of the literature reported earlier has focused on variable-centered analysis and

regression methods exploring bivariate associations between multiple risk factors. Even so, the existing literature that accounts for multiple risk factors (i.e., substance use, depressive symptomology, and violence experiences) concurrently suggests strong associations between these variables (DuRant, Altman, Wolfson, Barkin, Kreiter, & Krowchuk, 2000; Kilpatrick et al., 2000; Pinchevsky, Fagan, & Wright, 2014). Considering the role of substance use, depressive symptomology, and violence experiences may help explain adolescent risk-profiles and provide useful information for future intervention efficacy studies.

Thus, the purpose of Study 2 is to utilize a latent class analysis (LCA) to identify Mexican adolescents risk profiles. The use of LCA has several advantages over regression models, the LCA framework may help provide a more comprehensive characterization of adolescents based on multiple indicators, such as behavior, exposure to risk, and response to intervention (Lanza & Cooper, 2016). Furthermore, researchers have called for studies that explore how multiple risk factors may help differentiate adolescents from each other; something that would be possible with a pattern-centered analysis, such as LCA.

In this dissertation, I seek to answer two important and innovative questions. First, I address the question: Does depressive symptomology moderate the effects of *kiR*, a school-based substance use universal prevention program? This research question is explored in study 1. Utilizing a subsample of a Mexican adolescents participating in randomized controlled trial of *kiR*, the study tests the interaction effects of *kiR* and depressive symptomology on adolescents' alcohol resistance strategies and alcohol use.

In this study, I employ longitudinal structural equation modeling (SEM) to answer the research question.

In study 2, I aim to develop subgroups of risk profiles among Mexican adolescents based on their experiences with violence-witnessing, victimization, and perpetration, depressive symptomology, and substance use, (alcohol, cigarette, and marijuana). In this cross-sectional study I seek to identify subgroups of adolescents based on those risk indicators using LCA. Overall, the results of these studies can help inform researchers and practitioners of the complex dynamics between depressive symptomology, violence experiences, and substance use among Mexican adolescents. Second, the results of the LCA and the SEM moderators will provide insight into subgroups of participants and risk factors that can be used to guide intervention efficacy and improve prevention efforts.

#### CHAPTER 2

## GENERAL METHOD

Data for this dissertation are from a multisite, longitudinal, randomized controlled trial (RCT) testing the efficacy of *keepin' it REAL (kiR)*. Briefly, *keepin' it REAL (kiR)* is a school-based universal substance use prevention program that was developed and implemented with Latinx and Native American youth in Phoenix, Arizona (Gosin, Marsiglia, Hecth, 2003; Hecht et al., 2003). Theoretically grounded in communication competence theory (Spitzberg & Hetch, 1984), *kiR* incorporates culturally-relevant narratives via 10 weekly lessons and videos demonstrating the use of drug resistance strategies. The students' teachers receive training on the program and deliver these lessons in the classroom using highly interactive approaches which have been found to be effective among prevention programs for youth (Tobler et al., 2000). The *kiR* curriculum focuses on supporting the development of knowledge, motivation, and skills necessary to promote the acquisition and use of adaptive drug resistance strategies among adolescents all within the cultural context, norms, and values of the target community (Hecht et al., 2003; Marsiglia & Hecht, 2005).

Among diverse samples of adolescents in domestic (e.g., Mexican American in the Southwest) and international (e.g., Guatemala) contexts, *kiR* has been shown to have favorable substance use prevention outcomes, including decreased intention to use alcohol and drugs and increased use of drug resistance strategies (Kulis et al., 2005; Kulis et al., 2019). A linguistically adapted version of *kiR* has demonstrated short-term and long-term effects in reducing frequency of alcohol use (Marsiglia et al. 2015a; Marsiglia et al., 2015b) among Mexican adolescents. Overall, *kiR* has an extensive history as an efficacious universal substance use prevention program.

## **Data and Procedures**

The purpose of the RCT of *keepin it REAL* in Mexico is to test a newly developed culturally-adapted version of *kiR*, relative to the original, linguistic-adaptation of *kiR*, and a control group. Though a full description of the cultural adaptation of *kiR* is beyond the scope of this dissertation, the adapted *kiR* maintained the core concepts of *kiR* while incorporating culturally relevant language, videos, norms, attitudes, and beliefs salient among Mexican adolescents (for a full description of the cultural adaptation process see Marsiglia et al., 2019). The goal of larger Mexico RCT is to test whether this new version of *kiR* has stronger desired effects among Mexican adolescents relative to the original *kiR* version and control condition. This project has been possible due to an extensive partnership between researchers in Mexico and the United States. The Mexico team has focused on recruitment and retention, program implementation, data collection, and data entry. The U.S. team has provided technical assistance, delivered trainings, developed necessary protocols, and conducted statistical analysis of program efficacy.

Program implementation and data collection commenced in Fall 2018. Thirty-six *secundarias* (middle schools) across the Mexico City, Guadalajara, and Monterrey metropolitan areas were randomized into one of the three conditions (12 per city of data collection). Students at each school completed pre-intervention (T1) surveys focused on assessing substance use, substance use expectancies and motives, use of drug resistance strategies, parent-child relationships, violence experiences, and depressive symptomology, to name a few. In this dissertation I use a subset of the measures included

in the larger RCT, for a complete list of the measures included in this dissertation see appendix A. Following T1 data collection, teachers began weekly administration of the 10-session curriculum to their respective classrooms. Post-intervention (T2) data collection took place two months after the conclusion of the program delivery. In total, 5523 7<sup>th</sup> grade students were enrolled in the study (average age = 11.86 years old; 51% Male, 49% Female) and provided data at T1.

## **Research Questions**

This dissertation includes two independent, yet interrelated, studies utilizing data obtained from this RCT of *kiR*. Study 1 includes the samples of adolescents who were randomized into the original *kiR* (linguistically adapted version) and control condition (N = 3742)<sup>1</sup>. This study tested the moderating effects of depressive symptomology on the effects of *KiR* using longitudinal structural equation modeling (SEM) and regression analysis. T1 included the intervention conditions, depressive symptomology, and control variables. T2 data included alcohol resistance strategies and alcohol use outcomes.

For study 2, I employed the entire sample across all three conditions (N = 5523); however, in this cross-sectional study I include only T1 data. Specifically, the aim of this study was to develop subgroups of risk profiles among Mexican adolescents based on their experiences with violence-witnessing, victimization, and perpetration, depressive symptomology, and substance use, (alcohol, cigarette, and marijuana). To this end in Study 2, I used LCA and latent class regression.

<sup>&</sup>lt;sup>1</sup> The culturally adapted version of kiR is currently undergoing efficacy testing as part of the larger RCT study and thus was excluded from this analysis.

# CHAPTER 3

# STUDY 1

Depressive Symptomology as a Moderator of the Substance Use Prevention Program -

Keepin' it REAL

## ABSTRACT

Adolescent substance use is a complex and significant public health concern that has received considerable attention among researchers and practitioners. The purpose of this study was to test a model on the efficacy of the school-based substance use universal prevention program, keepin' it REAL (kiR), among a sample of Mexican adolescents. Specifically, this this study examined the moderating effects of depressive symptomology on kiR. The total sample for this study was 3,742 adolescents, of which 48.7% (n =1,826) were enrolled in the intervention group and the other 51.2% (n = 1.916) were assigned to the control group. Participants' ages ranged from 11-17 years old (M = 11.87, SD = 0.54). Nearly half of the sample (48.6%) identified as female, and 50.8% as male. Analysis included Structural Equation Modeling. The results demonstrated that participation in kiR positively predicted alcohol resistance strategies and those resistance strategies were negatively and significantly associated with alcohol use. Further, depressive symptomology had a significant and negative effect on resistance strategies, a positive effect on alcohol use, and a significant interaction with intervention condition. In other words, the moderation hypothesis was supported and the effects of kiR on resistance strategies increase as the level of depressive symptomology of the adolescents increases. Collectively, the findings of this study add to the growing literature on the efficacy of kiR specifically, and school-based substance use universal prevention programs broadly. Implications for research and practice are discussed.

## LITERATURE REVIEW

Adolescent substance use is a complex and significant public health concern that has received considerable attention among researchers and practitioners (Gray & Squeglia, 2018). Alcohol use alone accounts for myriad negative health and psychosocial consequences during adolescence, including but not limited to poor mental health, suicidal ideation, unintended injuries, and interferences with developing appropriate social and coping skills (Chassin & DeLucia, 1996). Without intervention, adolescent alcohol misuse has the potential to result in pervasive negative effects throughout the lifespan. In response to these challenges, research efforts have focused on developing evidence-based interventions that seek to prevent or reduce the onset and frequency of alcohol use. School settings are critical contexts for alcohol use interventions among early adolescents and as such, have received considerable attention in the prevention science literature (Gray & Squeglia, 2018; Stephens et al., 2009).

Alcohol use universal prevention programs have an extensive history in the United States (Borsari, 2013). Yet, comprehensive meta-analysis and systematic literature reviews conclude that the effects of universal school-based prevention programs on alcohol use outcomes are mixed, meaning that many interventions are not effective at reducing alcohol use outcomes among adolescents, or that the effects are small and often disappear one year post-intervention (Foxcroft et al., 2011; Strøm, Adolfsen, Fossum, Kaiser, & Martinussen, 2014). Further, despite improvements in methodology and theory-driven interventions there is still much unknown about for whom and under which conditions programs are effective (Borsari, 2013; Werch & Owen, 2002). It is possible

that efficacy of universal substance use prevention interventions may be inconclusive due to un-assessed adolescent characteristics that impact the response to the intervention.

To develop the most effective interventions to prevent adolescent alcohol use it is imperative to understand characteristics of intervention participants that may prevent them from responding well to these efforts. For example, depressive symptomology is a significant correlate and predictor of adolescent alcohol use (Arévalo Avalos et al., 2019; Donovan, 2004) and as such may serve as a significant moderator of intervention effects. Exploring factors associated with intervention efficacy has the potential to advance the field of prevention science and to promote the health of vulnerable populations. The purpose of this study is to test the moderating effect of depressive symptomology on the efficacy of *keepin'it REAl (kiR)*, a school-based substance use prevention intervention among Mexican youth.

#### **Adolescent Alcohol Use in Mexico**

Recent estimates suggest that alcohol use among Mexican adolescents is a relatively common phenomenon. Lifetime alcohol use rates vary based on age and municipality of data collection. Yet, on average, between 53% and 59% of adolescents across Mexico have drunk alcohol at least once in their lifetime (Benjet, Borges, Méndez, Casanova, & Medina-Mora, 2014; Villatoro Velazquez et al., 2016). The rates of alcohol use among Mexican adolescents have been correlated positively with age, such that 82.5% of 17-year old adolescents reported lifetime alcohol use relative to 35% of 12-year old adolescents (Benjet et al., 2014). Adolescents residing in urban settings (e.g., Mexico City and Michoacán) reported greater frequency of alcohol use relative to their rural counterparts (e.g., Chiapas or Oaxaca), 56% versus 40% respectively (Villatoro

Velazquez et al., 2016). Further, recent/current rates of alcohol use and problematic drinking are also elevated. For example, measures of 30-day alcohol use indicate that at least 16% of Mexican adolescents aged 12-17 reported recent use and 8% reported having five or more drinks at a time (Reséndiz Escobar et al., 2018). These data clearly illustrate the severity of the issue and provide a strong justification for implementation of effective universal school-based substance use prevention strategies, such as *keepin' it REAL* in Mexico.

## keepin' it REAL and Drug Resistance Strategies

*Keepin'it REAl (kiR)* is a universal substance use prevention program originally developed and implemented with Latinx and Native American youth in the U.S. Southwest (Gosin, Marsiglia, & Hecth, 2003; Hecht et al., 2003). kiR is theoretically grounded in communication competence theory (Spitzberg & Hetch, 1984) and the 10week, school-based curriculum focuses on supporting the development of knowledge, motivation, and skills necessary to promote the acquisition and use of adaptive drug resistance strategies among adolescents (Hecht et al., 2003; Marsiglia & Hecht, 2005). Among diverse samples of adolescents in domestic (e.g., Mexican American in the Southwest) and international (e.g., Guatemala) contexts, kiR has been shown to reduce adolescent alcohol use outcomes, including 30-day alcohol use, and increase the knowledge, motivation, and use of drug resistance strategies (Kulis et al., 2005; Kulis et al., 2019). Among adolescents in Mexico, *kiR* has demonstrated short-term and long-term effects in reducing frequency of alcohol use (Marsiglia et al., 2015a; Marsiglia et al., 2015b). Despite its success, research is lacking exploring the mechanisms via which this program is effective and examining the potential moderators of intervention efficacy.

At the crux of kiR is the promotion of drug resistance strategies. The REAL acronym represents the four primary drug resistance strategies targeted by the intervention – Refuse (saying 'No'), Explain (providing a justification in addition to saying 'no'), Avoid (staying away from contexts in which drug offers may be present), and Leave (removing one self from the situation in which drug offers are present) (Hecht et al., 2003; Marsiglia & Hecht, 2005). Yet, research has shown that diverse samples of adolescents employ a greater repertoire of resistance strategies than those originally emphasized by kiR; strategies such as ignoring the offer (Arévalo Avalos, Marsiglia, Ayers, Cutrín, & Kulis, 2018) and changing the topic of conversation or providing an excuse to avoid alcohol and other drug consumption (Kulis, Reeves, Dustman, & O'Neil, 2011). It is important to recognize that in addition to successful acquisition of the REAL strategies through kiR, adolescents also may use strategies such as changing the topic of conversation or ignoring a drug offer, even if these were not emphasized by the intervention. Unfortunately, to date, there is a lack of literature that explores the efficacy of this intervention on a wider repertoire of resistance strategies beyond the REAL set (i.e., refuse, explain, avoid, and leave).

Among Mexican adolescents, drug resistance strategies are associated with decreased substance use, including alcohol (Kulis, Booth, & Becerra, 2016; Kulis, Marsiglia, Ayers, Calderón-Tena, & Nuño-Gutiérrez, 2011). Thus, it follows that the greater the repertoire in resistance strategies the more likely that an adolescent would be to refuse alcohol offers and/or reduce alcohol use. These findings that drug resistance strategies are linked directly to alcohol use outcomes are consistent among diverse samples of adolescents in the United States participating in *kiR* interventions (Hecth,

Graham, & Elek, 2006) and among participants of other universal school-based alcohol use prevention programs (Stephens et al., 2009). The extant literature on drug resistance strategies having a significant and negative effect on substance use reinforces the theoretical link between these constructs. Further exploration of adolescents' acquisition of a wide range of resistance strategies in response to *kiR* may help future implementation of this and other universal school-based substance use prevention interventions.

# Alcohol Use and Depressive Symptomology

Adolescent onset of substance use poses a risk for development of mental health concerns in late adolescence and early adulthood (Gobbi et al., 2019). For example, depressive symptoms have been linked to alcohol use initiation (Wu et al., 2006) and subsequent alcohol use (Arévalo Avalos et al., 2019; Diego et al., 2003; Donovan, 2004) among diverse samples of adolescents. The relationship between depressive symptoms and alcohol use is complex and results regarding the cause-effect link between depressive symptoms and substance use are not always consistent. In a study among Mexican adolescents, Arévalo Avalos and colleagues (2019) found that alcohol use and depressive symptomology shared a reciprocal relationship such that depression predicted alcohol use at a later time point in the academic year and vice versa. According to Donovan (2004), other studies have partially supported these results, specifically that early and middle adolescent depressive symptoms predicted alcohol use initiation two to three years later (Brook, Whiteman, Gordon, Nomura, & Brook; 1986; Kaplow, Curran, Angold, & Costello, 2001). Depressive symptoms and substance use among adolescents are interconnected and, as such, depressive symptomology may be an important indicator of who may benefit from substance use interventions (Hernandez et al., 2015).

Unfortunately, little is known about how depressive symptomology may moderate the efficacy of interventions to prevent alcohol use among adolescents.

Since depressive symptomology predicts alcohol use, it is possible that adolescents with higher depressive symptomology will benefit the most from alcohol use prevention programs. Secondly, it is possible that adolescents with high depressive symptomology increase their sense of belonging in school through participating in universal prevention programs such as *kiR*; and as a result of the curriculum focused on knowledge, motivation, and skills, these students increase their self-efficacy in using a variety of drug resistance strategies that they would otherwise not be able or willing to use in the presence of drug and alcohol offers from their peers. Further examination of these hypotheses is warranted as uncovering the role of depressive symptomology in alcohol use prevention programs can help fine tune universal programs and/or provide future directions for program development that addresses comorbid substance use/mental health issues in adolescents.

## **Current Study**

The purpose of the current study is to test the moderating effects of depressive symptomology on the efficacy of *Keepin'it REAL (kiR)*, a school-based substance use prevention intervention for Mexican adolescents. A central tenet of *kiR* is the focus on helping adolescents develop the knowledge, motivation, and skills needed to practice drug resistance strategies and ultimately delay the onset or reduce substance use. To this end, this study will include measures of alcohol use resistance strategies and alcohol use resistance strategies and alcohol use risk factors as these are key, relevant constructs of *kiR*. The conceptual model of this

study is presented in Figure 1. The following hypotheses were derived from the extant literature on *kiR*, depressive symptomology, resistance strategies, and alcohol use.

- Hypothesis 1: Participating in *kiR* will (a) positively predict alcohol resistance strategies and (b) negatively predict alcohol use.
- Hypothesis 2: Alcohol resistance strategies will be negatively associated with alcohol use.
- Hypothesis 3: Depressive symptomology will moderate the efficacy of *kiR*.Specifically, adolescents with high depressive symptoms will benefit more from *kiR* compared to adolescents with low depressive symptoms.

Hypotheses 1 is a *confirmatory hypothesis* as research from pilot studies in Mexico has found a linguistically adapted version of the *kiR* curriculum to be effective at reducing/preventing alcohol use outcomes among Mexican adolescents (e.g., Marsiglia et al., 2015a). Hypothesis 2 is grounded in the extant research on *kiR* that has found a negative link between drug resistance strategies and substance use outcomes (e.g., Hecht et al., 2003). However, central to hypothesis 1 and 2 is the construct of alcohol resistance strategies, which is conceptualized in a novel way in the current study. Lastly, hypothesis 3 is based on findings that illustrate depressive symptomology is a risk factor for adolescent substance use (e.g., Donovan, 2004) and on the risk moderation hypothesis (Koning et al., 2012) which suggest those with the highest level of risks benefit the most from interventions. In other words, adolescents with higher endorsement of depressive symptomology may also have a high endorsement of alcohol use. Thus, adolescents with higher alcohol use would be expected to benefit the most from the *kiR* intervention given its focus on substance use prevention.

## METHOD

## **Data and Procedures**

This study is based on a secondary data analysis of a randomized controlled trial of kiR testing three conditions: a newly developed culturally adapted version of the kiR(Marsiglia et al., 2019), the original linguistically adapted version of kiR, and a control condition. The culturally adapted version of kiR has yet to undergo the rigorous statistical testing needed to prove it is effective at preventing substance use among Mexican adolescents. Thus, for this study only the original version of kiR and control conditions are being used as this will help elucidate the utility of depressive symptomology as a significant moderator of an effective intervention. Data for this project were collected in Fall 2018. Adolescents enrolled in diverse middle schools across the cities of Guadalajara, Monterrey, and Mexico City were randomized into either version of kiR or the control condition. The U.S. based research team provided capacity building and technical assistance for the local research team in Mexico. The team in Mexico delivered the intervention and conducted data collection. Baseline data (T1) was collected from all students enrolled in the RCT prior to the start of the 10-week kiR curriculum. Follow up/post-intervention data (T2) were collected four months later.

## Participants

The total sample for this study was 3,742 adolescents, of which 48.7% (n = 1,826) were enrolled in the intervention group and the other 51.2% (n = 1,916) were assigned to the control group. Participants' ages ranged from 11-17 years old (M = 11.87, SD = 0.54). Nearly half of the sample (48.6%) identified as female, and 50.8% as male. Nearly three quarters of the adolescents reported living in a two-parent household (73.9%).

Parent educational level varied from no formal education or elementary school (4.4%), middle school completion (23.7%), high school graduation (18.5%) or higher education (21.1%). Regarding educational aspirations for the study participants, less than 10% (8.7%) considered completing high school only but not attending college, almost a quarter (22.3%) reported interest in a technical/trade school, one in five (20%) reported interest in a bachelor's degree (20.6%), and 43.2% endorsed wanting to pursue a master's degree or higher. There was a roughly equivalent split regarding city of data collection, 38% of participants attended a middle school in Mexico City, 32% in Monterey, and 30% in Guadalajara.

### Measures

Alcohol Use Risk. Three items measuring 30-day frequency of alcohol use, 30day frequency of binge drinking, and 30-day frequency of drunkenness were used to create a composite score of alcohol use risk at both time periods, baseline (T1) and postintervention (T2). These questions were adapted from Graham et al., (1984) and have been used in various iterations of *kiR* since the development of the program (Hecht et al., 2003). Each question used the stem, "In the last 30-days how many times have you... [drank five or more alcoholic drinks in the same occasion]" and was rated using a 7-point Likert-type scale. The scale ranged from 0 (*never*) to 6 (*40 times or more*). The three indicators were added together to create a total composite score representing alcohol use risk. This composite score ranged from 0 to 18, with higher scores indicating a greater alcohol use risk, and had acceptable reliability indices ( $\alpha = .77$  at T1 and  $\alpha = .79$  at T2). Creating composite scores of single indicators of substance use is not an uncommon practice and has been used by others in evaluating intervention efficacy (Spirito et al., 2004).

**Depressive symptomology.** Depressive symptoms were assessed with the Center for Epidemiological Studies Depression Scale (CES-D, Radloff, 1977). The CES-D assesses depressive symptoms over the last 30-days. The scale includes 10 items and is rated using a 4-point Likert-type sale ranging from 0 (never or rarely) to 3 (almost always or always). Sample items include "I've felt depressed" and "I could not motivate myself". A total score was obtained by adding all the items together and multiplying by two. The final scores are measured on a scale of 0 to 60, with higher scores indicating greater level of depressive symptomology. A cut of score of 16 is considered clinically significant. In a scale validation study of the CES-D among 9-14 year old Mexican adolescents, Benjet, Hernandez-Guzman, Tercero-Quintanilla, Hernandez-Roque, and Chatt-Leon (1999) found this scale to be internally consistent (Cronbach's alpha ranging from .78 to .86 based on age and gender). In the current sample, the scale had an acceptable Cronbach's alpha of .74. Benjet et al. (1999) provided construct validity via comparisons of scale scores between the general population of adolescents and those recruited from psychiatric hospitals. Results indicated that adolescents with a diagnosed psychiatric condition reported higher rates of depressive symptoms than those in the general population with no mental health diagnosis. Further, Arévalo Avalos et al. (2019) found scores on the CES-D to negatively predict 30-day alcohol use among a sample of Mexican American adolescents.

Alcohol Resistance Strategies. Alcohol use resistance strategies at baseline and post-intervention were measured with latent constructs comprised of eight items. The

participants were asked to consider the hypothetical situation that "if a friend offered them alcohol (tequila) at a party, what would they do?". Participants responded to the eight-items using a 3-point Likert-type scale (0 = never, 1 = sometimes, 2 = always). Prior research has indicated that adolescents use a repertoire of resistance strategies, including REAL (Kulis et al., 2016) and non-REAL strategies (Kulis et al., 2011). Thus, the eight items included the REAL strategies described earlier (Refuse, Explain, Avoid, and Leave) and four additional strategies that may also be used by adolescents during alcohol offers, including Change the topic, Make up an Excuse, Ignore the offer, or Tell an adult. Typically, drug resistance strategies have been analyzed individually or as composites created by the mean (average use across all strategies) or repertoire methods (count of number of unique strategies used regardless of frequency). Yet, using a latent construct may be a more appropriate measure because it can account for measurement error while representing the use of these eight strategies as a single construct. In the current sample 2% of the participants reported they would only use one of the eight strategies above and 80% would use four or more. Thus, this would indicate that analyzing the collective use of drug resistance strategies might be a more accurate representation of this construct as used in adolescents' lives.

**Control variables.** A variety of demographic variables as well as baseline rates of alcohol use and alcohol resistance strategies served as covariates/control variables in this study. As adolescents get older, they are more likely to use alcohol and other drugs; thus, models controlled for age. Gender was also controlled in the analysis because prior studies of *kiR* have found that there are gendered-patterns in drug resistance strategies used and rates of alcohol use (Kulis et al., 2016) guiding the decision to control for

gender. Academic performance has been negatively associated with alcohol use and thus was included as a control variable (Bryant, Schulenberg, O'Malley, Bachman, & Johnston, 2003; Monahan, Oesterle, Rhew, & Hawkins, 2014). In this sample, adolescents' grades were assessed using a 4-point scale representative of academic performance in Mexico  $[1 = 4.0 - 6.9 (\sim D/E), 2 = 7.0 - 7.9 (\sim C), 3 = 8.0 - 8.9 (\sim B), 4 =$ 9.0 - 10.0 (~A)]. Grades average was 3.11 (SD = 0.75), which would be equivalent to a B average in the United States. Lastly, a single item measuring 30-day frequency of receiving alcohol, tobacco, and other drug offers from friends was included as a control variable because alcohol offers are positively associated with use of alcohol resistance strategies (Kulis et al., 2016). Responses to the friend alcohol, tobacco, and other drugs (ATOD) offers ranged from 0 (Never) to 4 (10 times or more) and the average was 0.22 (SD = 0.68). These variables, with the exception of alcohol use, did not statistically differ at baseline by intervention condition. Yet, all these variables were included in the analysis to ensure the effects on resistance strategies and alcohol use could be attributed to intervention condition and not be confounded by the control variable effects.

## **Analysis Plan**

Preliminary data analysis involved testing for baseline differences among the study variables by intervention and control condition. Descriptive statistics for each study variable by condition and totals are presented in Table 1. Following this analysis Structural Equation Modeling (SEM) was conducted to test the study hypothesis: (1a) *kiR* will have a positive effect on resistance strategies and (1b) negative effect on alcohol use risk; (2) resistance strategies will be negatively associated with alcohol use risk; and (3) depressive symptomology will moderate the effects of *kiR*. The analysis followed two
steps with the first focused on assessing the measurement model where the factor structure of the alcohol use risk latent variable was tested across both time points. This model included all variables of interest as covariates without specifying any directional paths. Next, the structural model which includes directional paths was estimated. At both steps of the process model fit was tested using the comparative fit index CFI  $\geq$  .95, the standardized root mean square residual SRMR  $\leq$  .08, and the root mean square of approximation RMSEA  $\leq$  .05 (Hu & Bentler, 1999). The full structural model was tested by specifying directional paths between constructs of interest while controlling for age, gender, grades, and baseline rates of resistance strategies and alcohol use risk. The SEM analysis was conduced using *MPlus* version 7.1 (Muthén & Muthén, 2015) with maximum likelihood estimation and bootstrapping (5,000 iterations) to obtain bias corrected standard errors of main and indirect effects. Descriptive statistics of the observed variables used for the latent constructs and the alcohol use risk composite scales are presented in Table 2.

### RESULTS

# **Measurement Model**

Two latent constructs were estimated (i.e., Alcohol Resistance Strategies at T1 and T2) in the measurement model (Figure 2). Each latent variable was defined by the eight drug resistance strategies: refuse, explain, avoid, leave, change, excuse, ignore, and *tell.* The original model indicated acceptable fit (CFI = .933; SRMR = .049; RMSEA = .044, RMSEA 90% CI = [.042, .046]; yet, without excellent fit indices the model fit of the structural model would be compromised. Modification indices suggested that allowing the items *excuse* and *change* to covary with each other would result in significant improvements to the overall model. It is possible these items represented 'two sides of the same coin' or have seen giving an excuse as a type of changing the topic. The model was modified based on these findings and the new model demonstrated excellent fit (CFI= .953; SRMR= .048; RMSEA= .036, RMSEA 90% CI= [.035, .038]). These modifications resulted in a significant improvement over the first model (Satorra-Bentler Scaled Chi Square Difference Test  $\Delta \chi^2 = 353.252$ , df = 2, p < .001). All of the observed variables loaded onto their respective latent construct with standardized path estimates  $\geq$ .50 (all  $p \le .001$ ).

# Structural Model

The structural model (Figure 3) included direct paths from intervention condition to alcohol resistance strategies and alcohol use risk, depressive symptomology to resistance strategies and alcohol use risk, and resistance strategies to alcohol use risk. In addition, the model estimated the moderating effect of condition by depressive symptomology on resistance strategies. All exogenous variables were from baseline (T1)

data and the endogenous/dependent variables were from post-intervention (T2) data. Control variables/covariates included age, gender, grades, friend substance use offers, resistance strategies, and alcohol use risk (all at T1). These results are presented in Table 3. The model had excellent fit (CFI = .955; SRMR = .031; RMSEA = .037, RMSEA 90% CI = [0.036, 0.039]). Participating in kiR positively predicted resistance strategies ( $\beta =$ 0.054, p < .01, 95% CI [0.015, 0.093]) but not alcohol use risk. In turn, resistance strategies were negatively and significantly associated with alcohol use risk ( $\beta = -0.236$ , p < .01, 95% CI [-0.276, -0.198]). Depressive symptomology was a significant predictor of resistance strategies ( $\beta = -0.111$ , p < .05, 95% CI [-0.166, -0.057]) and alcohol use risk  $(\beta = 0.042, p < .05, 95\%$  CI [0.008, 0.075]). Regarding moderation effects, there was a significant interaction between intervention condition and depressive symptomology ( $\beta =$ 0.056, p < .05, 95% CI [0.008, 0.088]), depicted in Figure 4. Adolescents with depressive symptomology who participated in kiR had a higher use of resistance strategies than those in the control group. There was a significant indirect effect of kiR on alcohol use risk via resistance strategies ( $\beta = -0.012, p < .01, 95\%$  CI [-0.022, -0.004]). In other words, the effect of kiR on alcohol use risk could only be detected when accounting for resistance strategies which suggests that kiR's effects on alcohol use are due in part to increase use of resistance strategies.

#### DISCUSSION

This study tested the efficacy of the school-based substance use universal prevention program, *keepin' it REAL*, among a sample of Mexican adolescents. Specifically, using structural equation modeling, this study tested the moderating effect of depressive symptomology on the effectiveness of kiR to increase adolescent alcohol resistance strategies and lower alcohol use risk. Overall, the study hypotheses were supported and some additional, unexpected findings emerged. First, the results demonstrated that participation in kiR positively predicted resistance strategies and those strategies were negatively and significantly associated with alcohol use. These associations accounted for baseline rates of resistance strategies and alcohol use, as well as demographic characteristics (i.e., age, gender, and grades). Further, depressive symptomology was as an important predictor in this model as it had a significant and negative effect on resistance strategies, a positive effect on alcohol use, and a significant interaction with intervention condition. In other words, the moderation hypothesis was supported and the preventive effects of *kiR* increase as the level of depressive symptomology of the adolescents increases. Collectively, the findings of this study add to the growing literature on the efficacy of kiR specifically, and school-based substance use universal prevention programs broadly.

In the current study, the moderation effects depicted in Figure 4 appear to suggest that, on average, participating in *kiR* will result in higher intentions to use resistance strategies, relative to control condition, independently of the level of depressive symptomology. This effect was clearly noticeable among adolescents with high depressive symptomology. *kiR* appears to buffer the risk effects that depression had on

adolescent adjustment. Without the intervention, adolescents with high levels of depressive symptomology have the worst resistance strategies outcomes, which translates into greater alcohol use. According to Petraitis, Flay, and Miller (1995), intrapersonal characteristics, such as depressive symptomology, do not have a direct effect on experimental alcohol use but rather have an indirect effect through substance specific beliefs. Thus, it may be that adolescents with high depressive symptomology have more positive attitudes toward alcohol use than their normative peers or have lower selfefficacy about using resistance strategies. Thus, participating in the intervention allows adolescents with high depressive symptomology the opportunity to develop more adaptive attitudes toward alcohol use and improve their self-efficacy in using resistance strategies.

In addition, participating in *kiR* predicted intentions to use resistance strategies, even after controlling for prior levels of resistance strategies. These findings are consistent with prior literature that has demonstrated adolescents participating in *kiR* develop a greater repertoire of drug resistance strategies and use these strategies with more frequency, relative to adolescents in control conditions (Hecht et al., 2003; Kulis et al., 2005). However, what was less understood was whether participating in *kiR* would also be effective at increasing the use of drug resistance strategies beyond those emphasized in the program – REAL. The use of the latent variable represents that adolescents, in fact, use a wider range of resistance strategies, which may include changing the topic of conversation, ignoring the offer, making up an excuse, or telling an adult. Also, on average the adolescents in this study reported they would use all strategies (REAL and non-REAL) at similar rates, providing additional support to the previous

hypothesis. These results are novel because prior efficacy research with *kiR* participants has not elucidated what other types of drug resistance strategies adolescents' use, if any (e.g., Kulis et al., 2011). Furthermore, adolescent use of various resistance strategies may suggest that (a) adolescents are recognizing the value of having a diverse repertoire of drug resistance strategies and (b) not any one strategy will be most effective for resisting substance use across a variety of contexts. These results are consistent with prior qualitative research with Mexican adolescents that found they use a variety of drug resistance strategies especially in the context of persistent offers and when refusing alone is not sufficient (Arévalo Avalos et al., 2018).

The use of structural equation modeling and latent variables to estimate the effect of resistance strategies on alcohol use risk is a strength of this study and helps move *kiR* efficacy research forward. As reported above, the association from resistance strategies to alcohol use risk was significant, indicating that adolescents with greater plans to use resistance strategies reported lower levels of alcohol use. Furthermore, there was a significant and negative indirect effect from intervention condition to alcohol use risk via the resistance strategies latent variable. The use of the latent variable accounts for measurement error that would not be captured via other methods and as such provide more accurate estimates of direct and indirect effects (Ledgerwood & Shrout, 2011). Prior research has demonstrated that alcohol use prevention programs are not often directly effective or that the effects wear off over time (Foxcroft et al., 2011; Strøm, Adolfsen, Fossum, Kaiser, & Martinussen, 2014). These undesirable effects might be explained by the lack of consideration of moderators and mediators on efficacy (Hernandez et al., 2015; Scheir, 2012). Thus, future studies testing program efficacy may benefit from use of SEM and longitudinal data analysis techniques such as those reported here. Further, for alcohol use prevention programs it may be crucial to examine indirect effects as these can help explore potential mechanisms via which changes takes place.

An important finding of this research study was that depressive symptomology represents a crucial factor to consider when conducing alcohol use interventions with adolescents. As noted earlier, depressive symptomology and alcohol use are strongly correlated and often predict each other (Arévalo Avalos et al., 2019). In this study, depressive symptomology (T1) was a significant predictor of alcohol use (T2) and it moderated the effects of the intervention on resistance strategies. To my knowledge, this is the first study of its kind to test the moderating effects of depressive symptomology on the efficacy of kiR. The results suggest that, without interventions such as kiR, adolescents who are struggling with depressive symptomology would be less likely to use adaptive resistance strategies and, as such, more likely to initiate alcohol use at an earlier age or engaging in frequent and problematic alcohol use. Unexpectedly, adolescents with low depressive symptomology also appeared to benefit from the intervention relative to those in the control condition (Figure 4). One possible explanation of this is that participating in kiR increases adolescents' sense of belonging in school, which, in turn, serves as a protective factor against depressive symptoms and emotional distress (Arévalo Avalos et al., 2019; Carvalho & Matos, 2014; Dunne, Bishop, Avery, & Darcy, 2017) and substance use (Brooks, Magnusson, Spencer, & Morgan, 2012; Wenzel, Weichold, & Silbereisen, 2009). Ongoing analysis of depressive symptomology as a moderator of intervention efficacy can help explore underlying mechanisms that lead to these effects.

# Implications

The results of this study suggest that school-based universal prevention programs aiming at reducing adolescent substance use would likely benefit from addressing the important issue of mental health and depressive symptomology. As noted earlier, adolescents with high levels of depressive symptomology end up with the worst substance use outcomes in the absence of effective interventions. Depressive symptomology negatively impacts use of resistance strategies, which results in greater alcohol use, and it appears that kiR buffers these negative effects. Thus, including some information about depressive symptomology and skills building around developing healthy coping skills might prove beneficial at reducing rates of mental health and substance use concerns among adolescents. The results of this study also suggest that depressive symptomology does not negatively impact adolescents' engagement and learning in kiR. If this were the case, then adolescents with higher depressive symptomology participating in kiR would not have benefited from the intervention; however, this was not supported by the research. Instead, these findings suggest that kiR is effective among adolescents regardless of depressive symptomology. Further, it may be important for researchers and practitioners to develop screening tools that target these high-risk adolescents in order to provide follow-up brief interventions that aim to booster the lessons learned through the primary prevention program. This would contribute to have the most significant impact among high-risk populations. Lastly, as reported earlier, the use of longitudinal data and SEM analytic methods can help increase the accuracy of research findings while exploring mediators and moderators of intervention efficacy.

#### Limitations and future directions

Despite testing a comprehensive model including theoretically linked constructs measured at two time points, a limitation of this study is that the dependent variables of alcohol resistance strategies and alcohol use risk were obtained at the same time point post-intervention. The decision to use alcohol resistance strategies as predictor of alcohol use was guided by theoretical considerations; yet, without longitudinal data and timing effects between these variables one cannot ascertain causality (Scheier, 2012). One additional wave of data collection would have provided the right data to test a full mediation model. Future research could prioritize longitudinal data collection in order to establish causality and directionality between constructs of interest.

Although the results of this study account for the effects of gender on resistance strategies and alcohol use, this study did not examine the potential moderating effects of gender on those outcomes. This remains a limitation of the study and provides areas for future direction. For example, testing competing models by gender may help elucidate if depressive symptomology has the same moderating effects for boys and girls. Similarly, a multi-group comparison by gender can help explore if the factor structure of the resistance strategies is equivalent for both boys and girls. Prior research has suggested gendered patterns exist in substance use and use of drug resistance strategies among adolescents and thus warrant further research.

Lastly, the data analysis presented in this dissertation has some limitations. First, the results of this analysis assume there are no nested effects of the intervention across the 32 schools of data collection or by the classrooms within schools. Future research should account for the possibility of nested effects. Furthermore, despite using SEM, only the resistance strategies variables were represented by a latent construct. Thus, the depressive symptomology and alcohol use variables did not account for measurement error and could introduce bias to the final results. Lastly, other mental health variables, such as anxiety, may better account for moderation effects and thus could be explored in future research.

# Conclusion

In summary, using longitudinal data and structural equation modeling, this study tested the efficacy of kiR, a school-based substance use program, and whether the effects of the intervention were moderated by depressive symptomology. In short, kiR directly predicted intentions to use resistance strategies and indirectly predicted alcohol use among a sample of Mexican adolescents. These findings indicate that substance use prevention programs may not have a direct effect on substance use outcomes, but rather on cognitions (e.g., intention to resist alcohol offers) associated with substance use. Adolescents' use of resistance strategies was associated with decreased alcohol use risk. Increasing adolescents' skills in navigating substance use offers is likely to help in substance use prevention efforts. Lastly, the effects of *kiR* were moderated by depressive symptomology. Specifically, kiR appeared to have a protective effect for adolescents with high depressive symptomology. Considering issues of adolescent mental health and depression-alcohol use comorbidity in the development of interventions may result in better substance use prevention outcomes. Finally, future substance use intervention research would benefit from exploring mechanisms associated with change and moderators of intervention efficacy.

#### **Bridging Study 1 and Study 2**

In the first study of this dissertation I answered the question: Does depressive symptomology moderate the effects of kiR, a school-based substance use universal prevention program? The results of this longitudinal study included: (a) kiR participation positively and significantly predicted adolescents' use of resistance strategies, (b) adolescents' use of resistance strategies was negatively and significantly associated with alcohol use, (c) depressive symptomology was a significant risk factor and negatively predicted resistance strategies and positively predicted alcohol use, (d) depressive symptomology moderated the effects of kiR such that the intervention buffered the negative effects of depressive symptomology on adolescent outcomes and (e), there was an indirect effect from kiR to alcohol use through resistance strategies, specifically kiR had a desired effect on alcohol use because it promoted resistance strategies. To my knowledge, this is the first study to test the moderating effect of depressive symptomology on kiR outcomes.

Study one highlighted the importance of examining how risk factors moderate intervention effects. Thus, study two will focus on developing subgroups of risk profiles among Mexican adolescents based on their experiences with violence (witnessing, victimization, and perpetration), depressive symptomology, and substance use (alcohol, cigarette, and marijuana). These risk factors are interrelated; yet, the majority of the available research on these topics does not examine these issues collectively. Researchers have called for more comprehensive research that simultaneously explores multiple risk factors and to use these findings for the development and testing of intervention effects. Thus, this cross-sectional study utilized latent class analysis to uncover these subgroups.

# CHAPTER 4

# STUDY 2

Violence Experiences, Depressive Symptomology, and Substance Use Among Mexican

Adolescents: A Latent Class Analysis

#### ABSTRACT

Violence experiences, depressive symptomology, and substance use pose significant threats to the wellbeing and health of adolescents. The purpose of this study was to explore subgroups (classes) of Mexican adolescent based on their experiences with violence (witnessing, victimization, and perpetration), depressive symptomology, and substance use (alcohol, tobacco, and marijuana). This study included 5520 Mexican adolescents between 11 and 14 years old who were recruited for a universal, schoolbased, prevention program for substance use. Seven indicators (violence witnessing, violence victimization, violence perpetration, depressive symptomology, alcohol use, cigarette/tobacco use, and marijuana use) were tested using Latent Class Analysis (LCA). Results suggested the data fit the model well and was able to estimate class memberships with high precision resulting in four empirically supported, well-differentiated latent classes. Fifty-five percent of the sample was included in Class 1 Moderate Risk-Violence, which represented the subgroup of adolescents with poly-violence experiences and low substance use. Class 2 Low Risk included 35% of the sample and represented the subgroup of adolescents with violence witnessing as the only risk factor, no additional violence, depression, or substance use. Nearly 8% of the sample was classified into Class 3 High Risk representing adolescents with poly-violence experiences, depression, and poly-substance use. Lastly, less than 2% of the sample comprised Class 4 Moderate Risk-Substance Use, which represented violence witnessing, low violence perpetration with poly-substance use. Implications for interventions and future research are discussed.

#### LITERATURE REVIEW

Violence experiences, depressive symptomology, and substance use pose significant threats to the wellbeing and health of adolescents. The associations between these constructs are dynamic and complex; yet, an extensive body of literature has linked childhood and adolescence exposure to family-based violence, interpersonal violence, and community violence with negative mental health outcomes, such as post-traumatic stress disorder and depression (Buka, Stichick, Birdthistle, & Earls, 2001; Ford, Elhai, Connor, & Frueh, 2010; Kilpatrick et al., 2003; Martinez & Richers, 1995; Osofsky, 1995) and with externalized problems, such as increased risk of alcohol or drug use and violence perpetration (Buka et al., 2001; Duke, Pettingell, McMorris, & Borowsky, 2010; Ford et al., 2010; Kilpatrick et al., 2003; Vermerein et al., 2003; Wright, Fagan, & Pinchevsky, 2013). Despite the extensive body of literature, most of the analysis conducted in this topic area only examines a couple of risk areas simultaneously. For example, violence victimization and mental health only, violence perpetration and substance use, or depression and substance use, to name a few. In addition, with few exceptions (e.g., Kulis et al., 2019; Nylund et al., 2007), most studies examining violence-depression-substance use links are based on cross-sectional data and/or variablecentered analysis. These limitations fail to elucidate the layers of comorbidity between violence experiences, depression symptomology, and substance use and how these factors manifest among adolescents. The goal of the current study is to identify subgroups of Mexican adolescents based on their experiences with violence, depressive symptomology and substance use.

#### The Context of Violence for Mexican Adolescents

Among Mexican adolescents (i.e., adolescents living in Mexico and not Mexican descendent or Mexican-American adolescents residing in the United States), exposure to a wide range of violence experiences may place them at increased risk of negative health outcomes. For example, due to a variety of risk factors including gangs and drug-related crime (Puyana et al., 2017), homicide rates among adolescents and young adults have more than doubled (from 10% to 25.5%) in Mexico from 2007-2010 (World Bank, 2012). Data from the latest national survey on victimization and perceptions of safety among Mexican adults found that two out of three adults reported witnessing alcohol use around their neighborhood, one in two reported experiencing drug use and frequent assaults or robberies, and one in three indicated knowledge of drug sales, gang presence, and frequent shootings (Instituto Nacional de Estadística e Informática, INEGI, 2018). The results from this survey highlighted that from 2013 - 2018 the sale and consumption of drugs increased from 23.4% to 33.8% and 40.1% to 50.6%, respectively (INEGI, 2018). The data presented here suggests that adolescents growing up in Mexico would likely be exposed to a variety of violence-related risk factors that may lead to negative mental health outcomes or externalized problems.

Research conducted with Mexican adolescents suggests there is a reciprocal relationship between frequent alcohol use and engagement in violence perpetration (i.e., criminal behaviors and bullying/aggression) and that these associations do not appear to be influenced by depressive symptomology, witnessing violence, or victimization experiences (Kulis et al., 2019). In addition, in an exploratory mixed-methods study among Mexican adolescents, the qualitative findings suggested that adolescents

witnessed community violence and aggressive acts in relation to drug sales and drug offers, and the quantitative data found witnessing violence was associated with 30-day alcohol, cigarette, and marijuana use and violence victimization was associated with 30day marijuana use (Arévalo Avalos et al., 2018). Additional research findings suggest that Mexican adolescents are also exposed to family-based violence in the forms of witnessing parental domestic violence, parental substance abuse, or being targets of abuse and neglect (Benjet et al., 2009) and that some of these experiences are linked to alcohol, tobacco and other drug use (Caballero, Ramos, González, & Saltijeral, 2010). These results illustrate that adolescents in Mexico may be exposed to various, inter-connected, sources of risk (e.g., violence and substance use). Yet, these findings do not provide any information about how these factors may cluster to explain risk profiles. They also do not account for the role of depressive symptomology or the link between violence victimization and perpetration. It is important to analyze violence experiences (including perpetration) together with substance use and depressive symptoms because these represent highly comorbid risk factors.

As noted above, violence experiences (e.g., witnessing, victimization) are associated with negative mental health outcomes (e.g., depression). For example, it appears that various forms of victimization, including sexual assault, physical assault, and witnessing violence are positively correlated with diagnosis of major depressive disorder among diverse adolescents in the U.S. (Ford et al., 2009; Kilpatrick et al., 2003; Turner, Finkelhor, & Ormrod, 2010) and increase depressive symptomology among Mexican American adolescents (Bauman & Summers, 2009). The inverse relationship also appears to be true, as evidence suggests depressed mood has been associated with violence perpetration (Banyard, Cross, & Modecki, 2006, Tschann, Flores, Pasch, & Marin, 2005). Furthermore, violence experiences in the form of witnessing and victimization, along with substance use, are predictors of violence perpetration (Resnick, Ireland, & Borowsky, 2004). Monahan, Oesterle, Rhew, and Hawkins (2014) found that the same risk and protective factors at the peer, family, and community level that influence externalized problems (substance use and antisocial behaviors) also influence depressive symptoms. Collectively, this body of literature provides evidence to suggest that violence witnessing, victimization, perpetration, depressive symptoms, and substance use are interrelated constructs. Given the interconnected web formed across all these adolescent risk factors it would be important to analyze all these constructs simultaneously. The shift to conducting a collective assessment of violence experiences, depressive symptomology, and substance use can help explore how these variables cluster together among adolescents and inform intervention efforts.

#### The Current Study

The purpose of this study is to explore subgroups of Mexican adolescents based on their experiences with violence (witnessing, victimization, and perpetration), depressive symptomology, and substance use (alcohol, tobacco, and marijuana). This study uses Latent Class Analysis (LCA) with the goal to uncover unique subgroups of adolescents based on these risk factors. LCA is an exploratory tool and, thus, no specific hypotheses are being made regarding which risk factors may cluster together to predict adolescent subgroups. Yet, the current study is grounded in the risk and resiliency ecological framework (Fraser, 1997; Kirby & Fraser, 1997), which is used to explain the emerging LCA subgroups. The risk and resiliency ecological framework posits that risk (influences contributing to negative adolescent outcomes) and protective (internal/external influences that mitigate risk) factors across the macro-, meso-, and micro-societal levels interact to determine how a child would adapt despite threats to their wellbeing (Fraser, 1997). In this study, seven risk factors will be explored and each can be mapped onto various levels of the ecological framework. In sum, the LCA results are contextualized within the risk and resiliency framework to explore how interactions of risk and possible protective factors explain the adolescent subgroups derived in this study. To date there has been extensive documentation on the prevalence of violence experiences and internalized/externalized problems among Mexican adolescents (e.g., Benjet et al., 2009; Escobar et al., 2018); yet, to my knowledge no study has explored adolescent subgroups based on diverse indicators of risk beyond those analyses involving correlational or regression methods. The results of this innovative study can help inform intervention efforts among Mexican adolescents.

#### **METHOD**

# **Data and Participants**

The data used for this study was obtained form the randomized controlled trial of the universal school-based prevention program *keepin'it REAL* described in the prior study. Briefly, the RCT of *kiR* was implemented in 36 schools across three cities in Mexico: Guadalajara, Monterrey, and Mexico City. Baseline, pre-intervention, data were collected during the Fall 2018. The entire sample of adolescents assigned to one of the three intervention conditions (*kiR* cultural adaptation, *kiR* original, and control) were analyzed for this study. In total, the sample included 5520 adolescents, between 11 to 14 years old (M = 11.86, SD = 0.55). For a complete description of the sample and rates of endorsement of the latent class indicators, see Table 4.

#### Measures

**Substance Use**. Three dichotomous, 0/1, items were created to represent adolescent use of alcohol, cigarette/tobacco, and marijuana. Across all items, a score of one represents any history and any amount of substance use. Specifically, three questions asked about 30-day frequency of using alcohol, cigarettes/tobacco, and marijuana use; three questions asked about lifetime frequency of using those three substances; and three questions asked about amount of using each substance. The questions used for each indicator of substance use were adapted from Graham et al. (1984) and are considered to be developmentally appropriate.

**Violence Experiences.** Three measures were used to assess experiences with violence – *witnessing, victimization, and perpetration.* The total scale score of each measure was dichotomized into a 0/1 scale, where a score of 1 indicated endorsement of

any item in that scale. *Witnessing Violence* was measured with an adapted version of the Things I Have Seen and Heard scale (Thompson et al., 2007). This scale included 10items assessing lifetime frequency of witnessing an act of violence in one's community (e.g., "I've seen someone get punched" or "I've heard gunshots"). *Violence Victimization* was assessed with the Exposure to Violence Checklist (EVC, Nadel, Spellmann, Alvarez-Canino, Lausell-Bryant, & Landsberg, 1996), which included 10-items measuring the lifetime frequency of experiencing an act of violence at home, in the neighborhood, or in school. Sample items include "You've been kicked" and "You've been threatened with a gun". *Violence Perpetration* was measured using the Violent Behaviors Committed Checklist (VBCC, Nadel et al., 1996). This scale included 10-items that assessed lifetime frequency of engaging in violent or aggressive acts, such as "kicked another person" or "threatened another person with a knife or sharp object."

**Depression Symptomology.** Depressive symptomology was assessed with the Center for Epidemiological Studies Depression Scale (CES-D) short version. The CES-D assesses depressive symptoms over the last 30-days. The CES-D includes 10 items and is rated using a four-point, Likert-type scale ranging from 0 (*never*) to 3 (*almost always or always*). Adding all the items and multiplying by two a total scale score was obtained ranging from zero to sixty. Based on prior literature, a cut of score of 16 was used to dichotomize the CES-D scale into 0/1, where one included scale scores of 16 or higher and represented clinically depressed symptoms (Grzywacz, Hovey, Seligman, Arcury, & Quandt, 2006). Scale sample items include "I've felt depressed" and "I could not motivate myself".

### **Data Analysis**

This study utilized Latent Class Analysis (LCA). LCA entails identifying empirically supported and well-differentiated latent classes (*K*) that represent homogenous response patterns across class within class members (Masyn, 2013). LCA is an exploratory tool that lacks clear criteria regarding the "correct model" and model fit, thus LCA requires estimation of a variety of competing models and assessing the absolute and relative fit of each model according to a wide range of diagnostic criteria (Masyn, 2013). LCA, instead of Latent Profile Analysis (which utilizes continuous variables), was used because the continuous variables included in the study represented highly skewed data that would pose estimation and interpretation challenges. Thus, to deal with these issues all the study variables were dichotomized and used within an LCA framework.

In this study, the LCA was conducted following the mixture model building recommendations provided by Masyn (2013) – specifically, the class enumeration process (e.g., model estimation/model fit) and selection of final unconditional model based on the statistical information and utility of each predicted class and class membership. All analyses were conducted using the *MPlus* version 7.1 (Muthén & Muthén, 2015) using maximum likelihood estimation with robust estimates (MLR) which accounts for missing data patterns and non-normally distributed data.

First, for the class enumeration process the first step included estimating a oneclass (k = 1) model and recording the log likelihood value (LL), number of parameters estimated (npar), the likelihood ratio chi-square goodness-of-fit statistic ( $\chi_{LR}^2$  with *df* and corresponding *p*-value) as well as information criterions (ICs) regarding relative fit. Specific ICs analyzed included the Consistent Akaike's Information Criterion (CAIC), Bayesian Information Criterion (BIC), and the Approximate Weight of Evidence Criterion (AWE) – across these ICs a lower value indicates a better model. Masyn (2013) reported that ICs may not arrive at a single lowest value and in these cases utilizing an "elbow" plot can help explore diminishing gains in model fit.

Next, this process was repeated for each additional class (K + I) until a nonidentified model was obtained. With the addition of each class, it was tested whether the model improved with additional classes. The parametric bootstrapped likelihood ratio test (BLRT), the Bayes Factor (BF) and the approximate Correct Model Probability (cmP) were recorded and analyzed. Collectively, these tests help determine whether the inclusion of one more class represents a better fitting model (e.g., BLRT, BF) and whether the model under consideration is the best model across all possible models (cmP) (Masyn, 2013). Similarly to ICs, Masyn (2013) reported, "elbow" plots can be used to assess fit regarding the BLRT.

Lastly, three of the best fitting models were selected and class membership classification diagnostic was analyzed to determine the most useful and parsimonious model. In this process, the Entropy ( $E_k$ ) was recorded and compared, which is a global assessment of classification precision for the entire sample across all *K*-classes (values of 1 = perfect classification). It is important to note, however, that  $E_k$  is not a tool to determine model fit but can aid in helping determine the utility of the LCA (Masyn, 2013). Further, the modal class assignments proportion (mcaP), the average posterior class probability (AvePP), and the Odd of correct classification ration (OCC) were analyzed. The mcaP compares the observed classification proportion to the model estimated classification proportions; larger discrepancies between these two indicating poor classification. The AvePP evaluates classification uncertainty for each class, values greater than .8 indicating adequate separation and classification precision. Lastly, the OCC is a function of the AvePP and the model estimated classification proportions, values greater than 5 indicating adequate separation and classification precision (Masyn, 2013). As described in this process, the information obtained from the class enumeration process is analyzed collectively to determine and choose a final model that represents the best fit to the data and most useful class membership classification.

#### RESULTS

# **Model Estimation and Model Fit**

A total of seven models were tested in this analysis; however, the 7-class model was unidentified (not estimated) as the best log likelihood value could not be replicated. This resulted in only six models to be considered in the class enumeration process. Table 5 reports a summary of the results from the class enumeration process and the model fit indices. The bold item represents the 'best fitting' model according to that index and the boxes represent the models under consideration for assessing class membership classifications.

Absolute fit was established for the 5-class and 6-class solutions, as evident by a non-significant  $\chi_{LR}^2$  and the lowest recorded log likelihood value. In terms of relative fit, the CAIC and BIC favored the 5-class solution as well as evidenced by the lowest obtained score in both of those ICs. Yet the lowest score on the AWE was found in the 3-class solution suggesting this model had the best fit compared to the rest. This is not unsurprising as the AWE tends to under-extract classes (Masyn, 2013) and, thus, may be indicative that a 4-class model is a better fit to the data.

The BLRT, BF, and cmP all favored the 5-class solution as well. Specifically, the BLRT demonstrated there were no statistically significant improvements to the model with the addition of a sixth class, the BF indicated that relative to the six-class solution the five-class solution was a better fit, and the cmP indicated that the five-class solution was the best solution across all six models tested. Most of the data appears to indicate the five-class solution was the best model to consider for the next step of estimating class membership. Yet, upon closer examination of the values obtained across several of the fit

indices it is evident that the LL, CAIC, BIC, and BLRT start to have marginal gains at the four-class solution, an observation that was also supported by "elbow" plots. In other words, based on these data, even though the 5-class model has the lowest IC values, the change from a 4-class to a 5-class does not appear to be meaningful, suggesting the 4-class model may be just as well as the 5-class model. The four-class and five-class were considered to be good enough models to assess for class membership and overall utility of the LCA and were considered into the next step of the enumeration process.

#### **Model Classification Diagnostics Results**

The 5-class model appeared to have adequate classification diagnostics; yet, the 4class model had better indices of classification across all evaluated criteria indicating this would represent a more useful model. Specifically, the 5-class model had an  $E_5 = .68$ ; the AvePP ranged from a low .71 to .82; and it had greater misclassification error as indicated by discrepancies between the mcaP and model-estimated class proportions. In contrast, the 4-class model had  $E_4 = .80$ , all AvePPs were above the preferred cut-off score of .80, and the mcaPs were all very close to the model-estimated class proportions. The full results of the 4-class classification diagnostics are reported in Table 6. In light of all the evidence presented, the 4-class models was chosen for further interpretation as it was considered the best representation of the data, the most parsimonious, and the most likely to provide useful information about classes and class memberships. Overall, the 4class model had high accuracy and precision in classifying adolescents into one of the four estimated classes.

# **Class Memberships and Class Descriptions**

The interpretation of the classes was based on the model estimated, class-specific item response probabilities (Table 7) and the visual representation of this data (Figure 5). Item response probabilities less than .30 or higher than .70 would indicate a high degree of class homogeneity and that item would be considered a useful indicator for defining each class. Class 1 was estimated to include 55.5% of the sample and was characterized by a high probability of endorsing violence experiences and a low probability of smoking cigarettes or marijuana. Given the high likelihood of endorsing violence experiences, Class 1 was labeled as "Moderate Risk-Violence." Class 2 was labeled "Low Risk" and was estimated to include 35.1% of the sample. This class was characterized by having a high probability of witnessing violence but the lowest probability of any other class indicator. In contrast, class 3 was labeled "High Risk" due to it being represented by a high probability of violence experiences, depressive symptomology, and poly-substance use. This class was estimated to include 7.8% of the sample. Lastly, Class 4 was the smallest class estimated at 1.6% of the sample and was characterize by low probabilities of victimization and depressive symptomology; but high a probability of witnessing violence and poly-substance use. This class was labeled "Moderate Risk-Substance Use."

Overall, there appears to be meaningful separation of the classes across a variety of the LC indicators as evaluated by the model estimated item-response odds ratios (Table 8) smaller than .02 or greater than 5.0. Specifically, Class 1 appears to be well separated from Class 2, as is Class 3 from Class 4, across the violence experience indicators. Class 1 is separated from Class 3 and Class 4 based on the low odds ratios of endorsing poly-substance use. Class 2 and Class 3 are separated by the low probability of

endorsing six of the LC indicators excluding witnessing violence. Class 2 is well separated from Class 4 based on probability of not endorsing poly-substance use.

# **Post-Hoc Latent Class Regression Analysis**

In an effort to provide additional information to support the validity of the LCA results, the role of gender in predicting latent class membership was explored. A Latent Class Regression, LCR, analysis was conducted, that accounted for conditional modal class probabilities and misclassification rates (Masyn, 2013). The results of the LCR are akin to a logistic regression. As such, the results that follow are presented as odds ratios (OR) when comparing gender effects across two classes. The results suggested there is a statically significant overall association with gender and risk profiles ( $\Delta \chi^2 = 19.591$ , df =3, p < .001). Specifically, given membership in either Class 1 Moderate Risk-Violence or Class 2 Low Risk, boys are more likely to be in Class 1 compared to girls (OR = 1.24, p = .004). Given membership in either Class 1 Moderate Risk-Violence or Class 4 Moderate Risk-Substance Use, boys are more likely to be in Class 4 Moderate Risk-Substance Use compared to girls (OR = 2.09, p = .013). Given membership in either Class 2 Low Risk or Class 3 High Risk, boys are more likely to be in Class 3 High Risk compared to girls (OR = 1.366, p = 0.016). Lastly, given membership in either Class 2 Low Risk or Class 4 Moderate Risk-Substance Use, boys were more likely to be in Class 4 Moderate Risk-Substance Use than girls (OR = 2.596, p = .001). On average, boys were more represented in the Moderate Risk-Violence, Moderate Risk-Substance Use, and High Risk Classes; whereas girls were more represented in the Low Risk class (Figure 6).

#### DISCUSSION

The purpose of this study was to identify subgroups (classes) of Mexican adolescent based on their experiences with violence (witnessing, victimization, and preparation), depressive symptomology, and substance use (alcohol, tobacco, and marijuana) using Latent Class Analysis. The results of the LCA suggested the data fit the model well and was able to estimate class memberships with high precision resulting in four empirically supported, and well-differentiated latent classes. Fifty-five percent of the sample was included in Class 1 Moderate Risk-Violence. Adolescents in this class had poly-violence experiences and low substance use. Class 2 Low Risk included 35% of the sample and represented the subgroup of adolescents with violence witnessing as the only risk factor, no additional violence, depression, or substance use indicators. Nearly 8% of the sample was classified into Class 3 High Risk, representing adolescents with poly-violence experiences, depression, and poly-substance use. Lastly, the remaining adolescents (1.6%) were included in the smallest class, Class 4 Moderate Risk-Substance, which represented violence witnessing with poly-substance use.

The majority of the adolescents in this sample were classified into the Moderate Risk–Violence class indicating they endorsed poly-violence experiences. Violence victimization and perpetration has been associated with exposure to other types of violence, such as community violence (Ford et al., 2010), family based violence (Duke et al., 2010; Espelage, Low, Rao, Hong, & Little, 2013), and interpersonal violence related to bullying (Espelage & Holt, 2008; Swearer, Song, Cary, Eagle, & Mickelson, 2001). Thus, it is possible the adolescents reporting poly-violence experiences are navigating multiple contexts (e.g, neighborhood, peers) in which violence regularly occurs. Further,

among early adolescents being a victim-bully is associated with depression (Espelage & Holt, 2008; Swearer et al., 2001) which can explain why over half of the adolescents in this subgroup endorsed depressive symptomology. Yet, despite these risk factors, the adolescents in this subgroup also appear to show protective factors, such as family and school connectedness (Resnick et al., 2004), that aid in promoting resiliency and lower risk for depressive symptomology and substance use.

The next largest subgroup appears to have the lowest level of risk overall. The Low Risk adolescents may represent those who have developed high levels of resiliency in response to adversity from risk factors, such as witnessing violence (Fraser, Galinsky, & Richman, 1999). For example, it is possible that witnessing violence in their neighborhood or family has decreased these adolescents susceptibility to violence victimization, as they have learned appropriate coping skills given their own lived experience (Christiansen & Evans, 2005; Nylund et al., 2007). Further, these adolescents may have access to a variety of protective factors (e.g., positive student-teacher interactions, social connectedness, neighborhood cohesion) (Christiansen & Evans, 2005; Kliewer & Murrelle, 2007) that could mitigate potential negative effects of violence, depression, and substance use.

As previous research has found, violence witnessing, victimization, and perpetration are significant risk factors for depressive symptomology and substance use (Kilpatrick et al., 2003; Kulis et al., 2019; Martinez & Richers, 1995; Nadel et al., 1996; Wright et al., 2013) and all these factors were endorsed by adolescents assigned to class 3 High Risk. Adolescents in this high-risk group are likely those with more chronic exposure to violence risk factor, significant depressive symptomology, and current or history of poly-substance use. It is possible that for these High-Risk adolescents their experiences with family based violence could be resulting in substance use (Caballero et al., 2010; Espelage et al., 2013). It may also be that these adolescents have experienced multiple and repeated traumatic victimizations (e.g., childhood sexual assault) or have been victimized due to their identity (e.g., sexual minority status) resulting in comorbid depression and substance use (Ford et al., 2010; Sassarego, Siller, & Edwards, 2019). Lastly, these adolescents may include those who engage with deviant peers and overt antisocial behaviors – characterized by aggression with the goal of hurting others, such as physical fighting (Burt, 2012). Considering the variety of risk factors, these adolescents appear to be at greatest risk of long-term negative physical and psychosocial outcomes.

Poly-substance use was also a risk factor for the subgroup of adolescents assigned to Class 4 Moderate Risk-Substance Use. Contrary to adolescents in the High-Risk subgroup, adolescents in this Moderate Risk-Substance Use group did not endorse high probability of depressive symptomology or violence perpetration. It is possible that for this subgroup of adolescents their reasons around the poly-substance use traced back to their peers' substance use and not any other deviant behaviors (Cutrín, Maneiro, Sobral, & Gómez-Fraguela, 2019). Furthermore, these adolescents may have also favorable drug attitudes, low perceived risk of drug use, or intentions to use drugs (Monahan et al., 2014). Despite representing only 1.6% of the entire sample, the adolescents classified into this subgroup represent a distinct group of adolescents relative to those in the other three groups. This is an important finding because it helps illustrate how adolescents who engage in poly-substance use vary regarding their experiences with other risk factors, such as violence experiences and depression.

It is important to note that among the adolescents in this study, witnessing violence was a common phenomenon (90% endorsed yes) but marijuana use was not (only 3% endorsed yes). Thus, most of the classes were not well differentiated by endorsement of these two variables. Yet, these indicators do provide a significant explanatory power to each of the classes. For example, adolescents in Class 3 High-Risk subgroup were 45 times more likely to report witnessing violence than adolescents in Class 4 Moderate Risk-Substance Use despite both of these classes having similar polysubstance use patterns. Thus, the odds ratios (Table 8) of endorsement of variables across classes help provide additional information about how these classes are similar or different.

Overall, these subgroups of adolescents appear to represent unique profiles of risk based on violence experiences, depressive symptomology, and substance use. The separation between subgroups can be understood from within the risk and resiliency ecological framework (Fraser, 1997). For example, it may be that adolescents in the moderate risk-substance use and high-risk subgroups are also exposed to additional risk factors (e.g., poor academic performance, social networks with deviant peers, bullying, family dysfunction) (Cutrín et al., 2019; Espelage et al., 2013; Kliewer & Murrelle, 2007; Monahen et al., 2014) that make them more susceptible to violence victimization or substance use. In contrast, it is possible that the adolescents in the moderate risk-violence subgroup have sufficient access to protective factors such as family support, prosocial involvement, or social skills (Buka et al., 2001; Monahen et al., 2014) that help them mitigate some of the potential negative effects of violence experiences and depressive symptomology. The results of the LCA appear to have strong utility. For example, the two subgroups most at risk for witnessing violence made up over 63% of the adolescents in this study. This statistic matches the national trends in Mexico that found 66% of adults reported knowledge about community level violence risk factors (e.g., presence of gangs, robberies, drug sales) (INEGI, 2018) and are consistent with reports that 69% of Mexican adolescents endorse of experiencing a traumatic event (Orozco, Borges, Benjet, Medina-Mora, & López-Carrillo, 2007). The fact that the rates of victimization experiences across these studies and the current results are roughly equivalent provides support for the LCA results presented in this discussion. Next, the two classes with adolescents reporting the highest probability of substance use accounted for 9.4% of the sample. This finding is consistent with national trends from Mexico that suggest about 8% of adolescents engage in risky substance use (e.g., binge drinking) (Reséndiz Escobar et al., 2018).

Lastly, the gender results demonstrated that girls generally are more likely to be assigned to the Low-Risk subgroup, whereas boys more likely to be represented across the other three classes. These results are consistent with prior research on the gendered effects of violence-perpetration and deviant behaviors. For example, findings suggest girls present lower antisocial behavior and less delinquent activities in comparison to males (Lanctôt, 2015; Schwartz & Steffensmeier, 2012; Nadel et al., 1996) and males engage in more bullying relative to females (Espelage & Holt, 2008). Thus, the evidence presented here suggests that the subgroups obtained from the LCA analysis are empirically supported and likely an accurate representation of adolescent risk profiles. Nonetheless, the proportion of boys and girls across each of the classes was fairly equivalent. In other words, girls were not absent from the higher-risk subgroups and boys

were not absent from the low-risk subgroup. These results are consistent with epidemiological data from Mexico that suggest adolescent females are drinking nearly as much as adolescent males (Villatoro Velázquez et al., 2016) but that there is no gender differences by alcohol use disorders (Benjet et al., 2014). It is possible that traditional gender roles found in the traditional Mexican context (e.g., *machismo and marianismo*) help elucidate the associations between gender and substance use among Mexican adolescents. That is, substance use may be more permissible among boys because it could be seen as an indication they are "becoming a man," whereas this would not be true for girls. Although this dissertation did not focus specifically on gender role exploration, the LCA results may provide useful information for future research.

### **Limitations and Future Directions**

Despite the contributions made by this study, it is not without limitation. First, it is important to acknowledge that even though the results from this study appear to have validity, the proposed model was exploratory, which means that the subgroups of adolescents described could be unique to this sample or the Mexican context. Testing this model with additional populations would strengthen the existence of these adolescent subgroups. Secondly, this study used correlational data and the LCA analysis does not imply causality between the class indicators. Thus, caution should be used to not interpret directionality in these results to suggest, for instance, that poly-violence experiences cause poly-substance use. Next, the dichotomization of the latent class indicators does not allow us to explore the severity or frequency of the various risk factors. In other words, the possibility of endorsing the violence perpetration should not be confounded with the notion that these adolescents perpetrated violence frequently. Similarly, an endorsement

of any of the substance use indicators could mean using that adolescent endorsed substance once or significantly more than once, either in the last 30-days or during one's lifetime. The lack of granularity and specificity regarding the 'strength' or 'severity' of these variables also limits the ability to quantify the level of risk that adolescents in each class may have actually experienced. Despite the measurement limitations, the fact that distinct subgroups of adolescents emerged does provide information regarding how risk and resiliency may play out among Mexican adolescents. Finally, despite having a representative sample of Mexican adolescents, the results presented only accounted for the role of gender in predicting class membership; thus no evidence could be provided about how these profiles may appear when accounting for age or social class.

Future research can advance this topic forward by addressing some of these limitations. For example, exploring additional demographic characteristics as predictors of class membership, such as academic performance or socioeconomic status, could help refine the interpretation of the subgroups. Testing theoretical predictors of class membership may contribute additional validity to the emergence of these subgroups. Similarly, including indicators that allow for a more sensitive level of analysis and testing for distal outcomes based on class membership can help explore the utility of these classes. Lastly, exploring models that also account for protective factors (e.g., positive parent-child relationships) can help develop a clearer picture about how risk and protective factors cluster together. Moving away from exclusively conducing variablecentered analysis (e.g., regression frameworks with singular indicators) to personcentered analysis (e.g., LCA) would be important as these findings can shed information for improving prevention efforts. The results of this study have important implications for prevention science and the development of interventions. Universal substance use prevention programs aim to deliver interventions to a wide range of adolescents with the goal of delaying the onset or reduce rates of alcohol, tobacco, and other drug use. In this framework, adolescent baseline differences regarding the level of risk are not accounted for as the intervention is delivered– which have the potential to interact with intervention effects. It is possible, then, the adolescent subgroups found in this study moderate the effects of interventions. Thus, understanding subgroups of adolescents based on various risk factors can help refine intervention delivery and/or help with recognizing adolescents at high risk postintervention with the goal of providing follow-up services or care.

In conclusion, this study found four groups of Mexican adolescents based on violence experiences, depressive symptomology, and substance use risk factors. Specifically, adolescent subgroups include those with poly-violence experiences and low substance use; violence witnessing as the only risk factor; poly-violence experiences, depression, and poly-substance use; and violence witnessing, low violence perpetration with poly-substance use. The results of this study help understand how various risk factors may cluster together among early adolescents and provide information about the utility of these groups in predicting risk and resiliency.

#### CHAPTER 5

### GENERAL DISCUSSION

This dissertation reports on two independent, yet interrelated, innovative studies. In the first study I answered the question: Does depressive symptomology moderate the effects of kiR, a school-based substance use universal prevention program among a sample of Mexican adolescents? The results of this longitudinal study suggest that kiR is an effective substance use prevention program for Mexican adolescents as it directly promotes alcohol resistance strategies resulting in decreased alcohol use. Depressive symptomology emerged as a significant risk factor because it hindered the use of resistance strategies and enhanced alcohol use. Finally, participating in kiR buffered the negative effects of depressive symptomology on adolescent adjustment. The results of study one provide evidence of kiR as an effective substance use prevention program with the potential to have protective effects among high-risk Mexican adolescents.

In the second study I identified subgroups of risk profiles among Mexican adolescents based on their experiences with violence (witnessing, victimization, and perpetration), depressive symptomology, and substance use (alcohol, cigarette, and marijuana). The results of this cross-sectional study using latent class analysis indicated that four, well-differentiated classes, representing various levels of risk and resilience exist among Mexican adolescents. The four classes included: Class 1 Moderate Risk-Violence included 55% of the sample and adolescents had poly-violence experiences with low substance use. Class 2 Low Risk included 35% of the sample and represented the subgroup of adolescents with violence witnessing as the only risk factor, no additional violence, depression, or substance use indicators. Nearly 8% of the sample was classified
into Class 3 High Risk, representing adolescents with poly-violence experiences, depression, and poly-substance use. Lastly, the remaining adolescents were included in the smallest subgroup, Class 4 Moderate Risk-Substance Use, which represented violence witnessing with poly-substance use.

Collectively, both of these studies provide relevant information specific to substance use prevention among Mexican adolescents. First, both studies illustrate the ways in which depressive symptomology is a risk factor for adolescents' adjustment and health. The results of both studies provide a more comprehensive understanding of how various risk factors may manifest in the lives of Mexican adolescents and result in increase risk for substance use. The studies demonstrate the importance of using novel research methods to examine complex multivariate risk and protective factors. Lastly, the findings provide important insights about the development and testing of universal substance use prevention programs and interventions.

#### **Depressive Symptomology as a Risk Factor**

The results of studies one and two demonstrate that depressive symptomology is a significant risk factor for Mexican American adolescents. For example, adolescents who endorsed a high level of depressive symptomology also endorsed violence experiences (witnessing, victimization, perpetration), poly-substance use. On the other hand, adolescents who endorsed low levels of depressive symptomology had the lowest level of cumulative risk factors and endorsed higher use of resistance strategies relative to their counterparts. These findings are consistent with the extant literature linking depressive symptomology as a risk factor for alcohol use among diverse (Donovan, 2014) and Mexican adolescents (Arévalo Avalos et al., 2019; Telumbre Terrero, López Cisneros,

Esparza Almanza; Guzman Facundo, 2017). Evidently, to be more successful in preventing adolescent substance use it is important to consider the role of depressive symptomology.

The findings from this dissertation provide directions for future research in the area of depressive symptomology-substance use comorbidity. For example, the results of the latent class analysis indicated that a small, yet significant, segment of the Mexican adolescents in this study endorsed poly-substance use despite having low probability of endorsing significant depressive symptoms. These adolescents mirrored the low-risk group, but were most different from the high-risk group, in terms of their likelihood of endorsing clinically significant depressive symptoms. Identifying differentiating characteristics (e.g., resiliency, coping skills, supportive adult relationships) between these three groups with contrasting depressive symptomology-substance use comorbidity may inform the development of effective interventions.

#### **Intersecting Risks and Methodological Advances**

Given the knowledge about risk, resiliency, and protective factors manifesting across different levels of the ecological framework (Hawkins et al., 1992; Fraser, 1997); the studies conducted approached the research questions with an integrative approach. Specifically, study one represented how internalized problems (e.g., depressive symptomology and intrapersonal processes (e.g., cognitions related to substance use) informed the effects of *kiR* (a psychosocial intervention delivered at the meso level), on adolescents' behavioral problems (e.g., substance use). Furthermore, this study used longitudinal structural equation modeling which allowed for estimating effects between constructs with more accuracy than possible via regression methods alone. This analytical approach embedded in study one represents a comprehensive method to assessing risk and resiliency and responds to the need of developing more research that examines how and for whom effective programs work (Hernandez et al., 2015; Scheier, 2012; Werch & Owen, 2002). Thus, the results of study one help advance the field of prevention science by providing evidence of how depressive symptomology moderates the effects of a successful universal prevention program.

Similarly, in study two multiple risk factors were included to develop a holistic representation of Mexican adolescents' risk profiles. The violence (witnessing, victimization, and perpetration) represented the macro and meso levels of the ecological framework; whereas the depressive symptomology and substance use indicators represented the micro level of the ecological framework. Furthermore, the inclusion of violence perpetration, depressive symptomology, and substance use allowed for the examination of how externalizing and internalizing behaviors manifest among Mexican adolescents. These results add to an increasing body of knowledge in which latent class analysis is being used to develop distinct profiles of adolescent behavioral problems in relation to exposure to social and individual risk factors (López-Romero et al., 2019; Maneiro, Gómez-Fraguela, López-Romero, Cutrín, & Sobral 2019).

#### **Generalizability of findings**

Substance use prevention research is gaining traction in Mexico. For example, as described earlier in this dissertation the adaptation, implementation, and testing of the *kiR* intervention among Mexican adolescents is an ongoing process. The results of these two studies provide additional data to the growing body of literature on the effects of universal prevention programs among Mexican adolescents and about how various risk

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variables may interact to represent adolescent risk profiles. The results of study 1 may help elucidate the importance of considering mental health issues among Mexican adolescents. For instance, the results in study 1 indicated that over 40% of the adolescents endorsed clinically significant depressive symptomology that may suggest mental health issues are a growing concern among Mexican adolescents residing in large metropolitan areas. Furthermore, the results of study 2 indicate that despite presence of community risk factors (e.g., violence) not all adolescents endorse substance use. This would suggest that some Mexican adolescents residing in other high-risk communities due to violence exposure would also have high levels of resiliency. Thus, additional research with Mexican adolescents in other contexts (e.g., rural communities) may help address some of these questions. The results of these studies may also generalize to the broader Mexican-American/Latinx adolescent population in the United States. For example, it is possible that family structures, cultural norms, gender roles, and substance use beliefs and expectancies are similar among Mexican adolescents and Latinx adolescents in the United States. Thus, it may be that correlates and predictors of substance use outcomes among Mexican adolescents are also found among Latinx adolescents in the U.S. Though there is some basis for suggesting these findings may extend to U. S. Latinx adolescents, replicating these studies with U.S.-based adolescent samples would provide additional information regarding the generalizability of the findings.

#### **Development and Testing of Interventions**

As shown in these results, interventions do not work the same for all adolescents and not all adolescents manifest the same risk-profiles. This may be common knowledge among prevention science research; still, what the results of this dissertation offer are a starting point for answering questions about intervention effects. In other words, the four risk-profiles described in study two could be used to predict moderation effects as those examined in study one. By using these risk-profiles in assessing intervention effects, researchers can examine if the intervention works differently depending on the type and severity of risk that adolescents have experienced. Furthermore, by testing the efficacy of universal prevention programs among various risk-profiles we can conclude whether the intervention works the same for all adolescents regardless of risk (unlikely). If instead there are differential effects of the intervention by risk profile, then this information can be used to develop and test adapted interventions that consider the role of multiple risk factors. A one-size-fits-all approach may not be effective. Interventions could be adapted to have a broader reach in improving diverse adolescent health outcomes. For example, Hawkins et al. (2015) reported that programs designed to prevent anxiety are also helpful in preventing depression, because anxiety often precedes depression. Similarly, substance-use prevention interventions may be adapted to have a wider effect on depressive symptomology and violence-related outcomes when administered to a wide range of children, regardless of risk exposure or presenting concerns.

In conclusion, the studies presented in this dissertation address important questions about adolescent substance use prevention. The data suggest that comorbid depressive symptomology and substance use are significant risk factors for adolescent adjustment and health. Furthermore, the societal context and exposure to various indicators of violence places adolescents at increased vulnerability for internalized and externalized behavioral problems.

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The most successful substance use universal prevention efforts will be those that have desired effects on the target behavioral outcomes (e.g., alcohol use) while also benefitting those with comorbidities and higher levels of risk.

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### APPENDIX A

## TABLES

	ke	epin' it REA	L			
Variable	Mean / Frequency	ean / Std. Dev. Range Mea.		Mean	Std. Dev.	Range
Gender	48.4%	Female, 51%	Male	48.9%	Female, 50.6	% Male
Age	11.88	0.55	11 – 17	11.86	0.53	11 – 14
Grades	3.04	0.75	1 – 4	3.17	0.75	1 – 4
Friend ATOD Offers	0.24	0.63	0-4	0.22	0.73	0-4
CES-D	15.90	10.5	0-60	15.64	10.49	0-60
Alcohol Use Risk (T1)	0.58	1.59	0 – 17	0.43	1.32	0 - 18
Alcohol Use Risk (T2)	0.94	1.97	0 – 13	0.88	1.97	0-18

Table 1. Descriptive Statistics by Intervention Condition (Study 1)

Note: N = 3,742 (n *keepin it REAL* = 1,826, n Control = 1,916). CES-D = Center for Epidemiological Studies – Depressed Scale (measure of depressive symptomology). ATOD = Alcohol, Tobacco, and other Drugs. Std. Dev. = Standard Deviation. No statistically significant differences found between variables across intervention conditions except for Alcohol Use Risk (T1) and Friend ATOD Offers, p < .05.

Latent Variable / Constructed Variable	Observed Variable	Mean	Standard Deviation	Range
(1 1 1 5				
Alcohol Resis	stance Strategies (TI)			
	Refuse	1.37	0.82	0 - 2
	Explain	1.17	0.86	0 - 2
	Avoid	1.33	0.82	0 - 2
	Leave	1.30	0.83	0 - 2
	Change	1.26	0.82	0 - 2
	Excuse	1.02	0.88	0 - 2
	Ignore	1.28	0.83	0 - 2
	Tell	1.33	0.85	0 - 2
Alcohol Resis	stance Strategies (T2)			
	Refuse	1.32	0.73	0 - 2
	Explain	1.18	0.75	0 - 2
	Avoid	1.23	0.78	0 - 2
	Leave	1.19	0.78	0 - 2
	Change	1.15	0.77	0 - 2
	Excuse	1.01	0.80	0 - 2
	Ignore	1 12	0.78	0 - 2
	Tell	1.24	0.82	0 - 2
Alcohol Use	Risk (T1) – 30 dav freaue	ncv of·		
	Drinking any alcohol	0.28	0.78	0 - 6
	Drinking Excessively	0.12	0.54	0 - 6
	Getting Drunk	0.11	0.49	0 - 6
Alcohol Usa	Pick (T2) 20 day frages	new of		
AILONDI USE	Drinking ony alashal	ncy oj.	0.05	0 6
	Drinking any alconol	0.40	0.93	0 - 0
	Cottine Drevels	0.21	0.08	0 - 6
	Getting Drunk	0.23	0.73	0 - 6

 Table 2. Descriptive statistics of observed variables used in measurement model

*Note*. N = 3,742

Table 3. Structura	l Equation N	Modeling Results
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Variables	В	SE B	β	95% CI
Alcohol Resistance Strategies (T2)				
Intervention $(0 = \text{control}, 1 = kiR)$	0.117	0.043	0.054**	(0.015, 0.093)
Depressive Symptomology	-0.012	0.003	-0.111**	(-0.166, -0.057)
Moderation Interaction	0.008	0.004	0.056*	(0.004, 0.109)
Gender ( $0 = $ female, $1 = $ male)	-0.056	0.043	-0.026	(-0.066, 0.012)
Grades	0.062	0.030	0.048*	(0.008, 0.088)
Friend ATOD Offers	-0.144	0.037	-0.091**	(-0.134, -0.045)
Alcohol Resistance Strategies (T1)	0.364	0.030	0.337**	(0.291, 0.385)
Model R <sup>2</sup>		0.151**		
Alcohol Use Risk (T2)				
Alcohol Resistance Strategies (T2)	-0.435	0.040	-0.236**	(-0.276, -0.198)
Intervention $(0 = \text{control}, 1 = kiR)$	-0.004	0.066	-0.001	(-0.032, 0.033)
Depressive Symptomology	0.008	0.003	0.042*	(0.008, 0.079)
Moderation Interaction	-0.006	0.007	-0.022	(-0.071, 0.025)
Gender ( $0 = $ female, $1 = $ male)	-0.134	0.066	-0.033*	(-0.067, -0.002)
Grades	-0.078	0.046	-0.029	(-0.064, 0.004)
Friend ATOD Offers	0.294	0.096	0.101**	(0.038, 0.166)
Alcohol Use Risk (T1)	0.503	0.062	0.370**	(0.288, 0.449)
Model R <sup>2</sup>		0.264**		

*Note.* N = 3,742. Moderation Interaction = Intervention\*Depressive Symptomology. ATOD = Alcohol, Tobacco, and Other Drugs. \* p < .05, \*\* p < .01.

Variable	Ν	Mean / % Yes	SD / Range
Age	5503	11.89	0.54 / 11 – 14
Female / Male	5490	49% / 51%	
Household Size	5461	4.23	1.012 / 1 - 8
Two Parent Household	5431	75.1%	
Violence Witnessing	5402	90.1 %	
Violence Victimization	5374	33.4 %	
Violence Perpetration	5379	57.2 %	
Depressive Symptomology	5332	43.4 %	
Alcohol Use	5520	62.1 %	
Cigarettes Use	5435	10.7 %	
Marijuana Use	5459	3.1 %	

Table 4. Sample Descriptive Statistics (Study 2)

Model	LL	LL np		df	$\chi_{LR}^2$	CAIC	BIC	AWE	(H0:K c H1:K+1	lasses; classes)	BF (K	cmP(K)
(K-class)		ar	<b>N</b> <sup>EIQ</sup>	-9	p-value					BLRT p-value	(+1, K+1)	()
1-class	-18748.63	7	422.61	115	<.001	37564.56	37557.56	37638.88	2899.29	<.001	0.000	0.000
2-class	-17298.98	15	870.75	106	<.001	34742.20	34727.20	34901.44	823.82	<.001	0.000	0.000
3-class	-16887.07	23	287.09	101	<.001	33995.31	33972.31	34239.48	113.40	<.001	0.000	0.000
4-class	-16830.37	31	180.30	93	<.001	33958.83	33927.83	34287.93	85.98	<.001	0.000	0.000
5-class	-16787.38	39	94.01	85	0.236	33949.79	33910.79	34363.82	19.42	0.05	>10	1.000
6-class	-16777.67	47	75.071	78	0.573	34007.30	33960.30	34506.26	n/a	n/a	n/a	0.000
7-class	lass Unidentified											

Table 5. Model Fit Indices for Latent Class Analysis of Violence Experiences, Depressive Symptomology and Substance Use

*Note.* LL = log likelihood, npar = number of parameters estimate. CAIC = Consistent Akaike's Information Criterion. BIC = Bayesian Information Criterion. AWE = the Approximate Weight of Evidence Criterion. BLRT = bootstrapped likelihood ratio test. BF = Bayes Factor (BF). cmP = Correct Model Probability.

Class K	Estimated proportion	mcaP	AvePP	OCC
Class 1: Moderate Risk-Violence	0.569	0.555	0.916	8.26
Class 2: Low Risk	0.340	0.351	0.852	11.17
Class 3: High Risk	0.072	0.078	0.838	66.48
Class 4: Moderate Risk-Substance Use	0.019	0.016	0.82	236.61

Table 6. Model Classification Diagnostics ( $E_4 = .80$ )

*Note.* mcaP = modal class assignments proportions, AvePP = average posterior class probability, OCC = Odd of correct classification. Good classification precision: AvePP > .80; OCC > 5.0.

Latent Class Indicator	Class 1 (55.5%) Moderate Risk – Violence	Class 2 (35.1%) Low Risk	Class 3 (7.8%) High Risk	Class 4 (1.6%) Moderate Risk- Substance Use
Violence Witnessing	.972	.768	.994	.786
Violence Victimization	.910	.215	.967	.262
Violence Perpetration	.812	.109	.922	.341
Depressive Symptomology	.544	.196	.727	.255
Alcohol Use	.415	.164	.966	.924
Cigarettes Use	.039	.007	.951	.902
Marijuana Use	.002	.003	.278	.432

Table 7. Model Estimated, Class-Specific Item Response Probabilities.

*Note*. Bolded items indicate high degree of homogeneity (Item Response Probability <.30 or > .70) within class

Latent Class Indicator	Class 1 vs. 2	Class 1 vs. 3	Class 1 vs. 4	Class 2 vs. 3	Class 2 vs. 4	Class 3 vs. 4
Violence Witnessing	10.655	0.213	9.621	0.020	0.903	45.196
Violence Victimization	36.892	0.347	28.503	0.009	0.773	82.105
Violence Perpetration	35.163	0.364	8.331	0.010	0.237	22.897
Depressive Symptomology	4.899	0.447	3.490	0.091	0.712	7.807
Alcohol Use	3.611	0.025	0.058	0.007	0.016	2.314
Cigarettes Use	5.766	0.002	0.004	0.000	0.001	2.111
Marijuana Use	0.685	0.006	0.003	0.008	0.004	0.505

Table 8. Model Estimated Item-Response Odds Ratios for All Pairwise Comparisons by Latent Class.

*Note*. Bolded items indicate high degree of separation (Item-Response Odds Ratio < 0.02 or > 5.0) between classes. Class 1: Moderate Risk-Violence; Class 2: Low Risk; Class 3: High Risk; Class 4: Moderate Risk-Substance Use.

### APPENDIX B

## FIGURES



Figure 1. Conceptual Model – Moderation of *keepin' it* REAL Effects (Study 1)



Figure 2. Measurement Model of Alcohol Resistance Strategies



Figure 3. Structural Model Testing the Efficacy of keepin' it REAL.

*Note.* Control variables and non-significant paths were removed for presentation. Standardized regression coefficients reported. \*p < .05, \*\*p < .01



Figure 4. Interaction Effects of Intervention and Depressive Symptomology on Alcohol Resistance Strategies

*Note*. Simple slope tests indicated significant slopes low (0.159, p < .01) and high (0.327,p < .01) levels of depressive symptomology



Figure 5. Model estimated, class-specific item probability profile plot for the four-class solution (Study 2)

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# Figure 6. Proportion of Modal Class Membership by Gender

### APPENDIX C

MEASURES USED IN PRESENT STUDIES

These were the original measures (as presented to study participants during data collection) and translation provided by this author (for dissertation purposes only.

### Substance Use Frequency Scale – 30 days

Piensa sobre tus experiencias con alcohol, tabaco, y drogas <u>en los últimos 30 días</u> , aun si no quisieras usarlos.	Ninguna	Solo una	2-3 veces	4-9 veces	10-19 veces	20-39 Veces	40 o más veces
A. ¿En los últimos 30 días, cuántas veces has bebido más de un sorbo de alcohol (cerveza, vino, pulque, tequila, whisky, ron, etc.)?	0	1	2	3	4	5	6
B. ¿Cuántas veces tomaste cinco o más bebidas alcohólicas seguidas (en la misma ocasión)?	0	1	2	3	4	5	6
C. ¿Cuántas veces te has emborrachado?	0	1	2	3	4	5	6
D. ¿Cuántas veces has fumado cigarrillos o tabaco?	0	1	2	3	4	5	6
E. ¿Cuántas veces has fumado marihuana (hierba)?	0	1	2	3	4	5	6

Think about your experiences with alcohol, tobacco, and drugs during the past 30 days, even if you do not want to use them.	Never	Once	2-3 times	4-9 times	10-20 Times	20 – 39 times	40 or more times
A. In the last 30 days, how many times have you drank more tan one sip of alcohol (beer, wine, <i>pulque</i> , tequila, whiskey, rum, etc.)?	0	1	2	3	4	5	6
<b>B.</b> How many times did you drink five or more alcoholic beverages one after another (in the same occasion)	0	1	2	3	4	5	6
<b>C.</b> How many times have you gotten drunk?	0	1	2	3	4	5	6
<b>D.</b> How many times have you smoked cigarettes or tobacco?	0	1	2	3	4	5	6
E. How many times have you smoked marijuana (weed)?	0	1	2	3	4	5	6

# Substance Use Frequency Scale – Lifetime

Ahora, piensa sobre <u>toda tu vida</u>	Ninguna	Solo una vez	2-3 veces	4-9 veces	10-21 veces	20 – 39 veces	40 o más veces
A. ¿En toda tu vida, cuántas veces has bebido más de un sorbo de alcohol?	0	1	2	3	4	5	6
B. ¿Cuántas veces has fumado tabaco o cigarrillos?	0	1	2	3	4	5	6
C. ¿Cuántas veces has fumado marihuana?	0	1	2	3	4	5	6

Now, think about your entire life	Never	Once	2-3 times	4-9 times	10-22 Times	20 – 39 times	40 or more times
A. In your lifetime, how many times have you had more than a sip of alcohol?	0	1	2	3	4	5	6
B. How many times have you smoked cigarettes?	0	1	2	3	4	5	6
C. How many times have you smoked marihuana?	0	1	2	3	4	5	6

# **Depressive Symptomology Scale**

¿Durante <u>los últimos 30 días</u> , con qué frecuencia te has sentido de esta manera?:	Nunca o rara vez	Algunas o pocas veces	Ocasionalmente o con moderación	La mayor parte o todo el tiempo
A. Me sentí deprimido (a)	0	1	2	3
B. Sentí que todo lo que hacía requería un gran esfuerzo	0	1	2	3
C. Dormí mal	0	1	2	3
D. Me sentí feliz	0	1	2	3
E. Me sentí solo/a	0	1	2	3
F. La gente no fue amistosa	0	1	2	3
G. Disfruté de la vida	0	1	2	3
H. Me sentí triste	0	1	2	3
I. Sentí que no le caía bien a los demás	0	1	2	3
J. No pude motivarme	0	1	2	3

During <u>the last 30 days</u> , how frequently have you felt this way?	Never or rarely	Some or a few times	Occasionally or moderately	Most or all of the time
A. I felt depressed	0	1	2	3
B. I felt that everything I did required great effort	0	1	2	3
C. I felt badly	0	1	2	3
D. I felt happy	0	1	2	3
E. I felt alone	0	1	2	3
F. People were not friendly	0	1	2	3
G. I enjoyed life	0	1	2	3
H. I felt sad	0	1	2	3
I. I felt that others didn't like me	0	1	2	3
J. I couldn't motivate myself	0	1	2	3

# Alcohol Resistance Strategies Scale

Ahora piensa sobre una situación hipotética. ¿Si un amigo o amiga te ofreciera tequila en una fiesta, qué harías?		A veces	Siempre
A. Dirías que "NO" o "No, gracias" sin decir por qué.	0	1	2
B. Dirías que "NO" y explicarías por qué.	0	1	2
C. Te alejarías de la situación o del lugar.	0	1	2
D. Intentarías cambiar de tema.	0	1	2
E. Darías una excusa.	0	1	2
F. Evitarías estos lugares y situaciones	0	1	2
G. Ignorarías a la persona o la situación.	0	1	2
H. Le dirías a un adulto lo que pasó.	0	1	2

Now think about this hypothetical situation. If a friend offered you tequila at a party, what would you do?	Never	Sometimes	Always
A. You would say "NO" or "No, Thank you" without saying why.	0	1	2
B. You would say "NO" and explain why.	0	1	2
C. You would leave the situation or place.	0	1	2
D. You would try and change the topic.	0	1	2
E. You would give an excuse.	0	1	2
F. You would avoid those places and situations	0	1	2
G. You would ignore the person or situation	0	1	2
H. You would tell an adult.	0	1	2

# Witnessing Violence Scale

¿Cuántas veces <u>en tu vida</u> has visto o escuchado estas cosas alrededor de tu casa o colonia ( <u>no</u> en la televisión o en películas)?	Nunca	Una vez	2 veces	3 veces	4 o más veces
A. He escuchado disparos.	0	1	2	3	4
B. He visto como arrestan a alguien.	0	1	2	3	4
C. He visto una venta de drogas.	0	1	2	3	4
D. He visto a alguien ser golpeado.	0	1	2	3	4
E. He visto cuando apuñalaban a alguien.	0	1	2	3	4
F. He visto cuando le disparaban a alguien.	0	1	2	3	4
G. He visto pandillas en mi barrio.	0	1	2	3	4
H. He visto a alguien apuntando con un arma de fuego a otra persona	0	1	2	3	4
I. He visto a alguien amenazando con un cuchillo a otra persona.	0	1	2	3	4
J. He visto a alguien robar una casa o un negocio.	0	1	2	3	4

How many times <u>in your life</u> have you seen or heard these things around your home or neighborhood (not on television or in movies)?	Never	Once	2 times	3 times	4 times or more
A. I have heard shots.	0	1	2	3	4
B. I have seen someone be arrested.	0	1	2	3	4
C. I have seen a drug sale.	0	1	2	3	4
D. I have seen someone get hit.	0	1	2	3	4
E. I have seen someone get stabbed.	0	1	2	3	4
F. I have seen someone get shot.	0	1	2	3	4
G. I have seen gangs in my neighborhood.	0	1	2	3	4
H. I have seen someone pointing a gun at another person.	0	1	2	3	4
I. I have seen someone threatening another person with a knife.	0	1	2	3	4
J. I have seen someone steal a house or a business.	0	1	2	3	4
#### Violence Victimization Scale

¿En tu casa, colonia, o escuela, cuántas veces <u>en tu vida</u> alguien te ha	Nunca	Una vez	2 veces	3 veces	4 o más veces
A. Golpeado?	0	1	2	3	4
B. Pateado?	0	1	2	3	4
C. Empujado?	0	1	2	3	4
D. Lastimado?	0	1	2	3	4
E. Amenazado con un cuchillo o un objeto afilado?	0	1	2	3	4
F. Atacado con un cuchillo o un objeto afilado?	0	1	2	3	4
G. Amenazado con una pistola?	0	1	2	3	4
H. Disparado con una pistola?	0	1	2	3	4
I. Abusado verbalmente o emocionalmente (te han dicho algo que te hizo sentir mal)?	0	1	2	3	4
J. Robado	0	1	2	3	4

In your home, neighborhood, or school, how many times in your life has someone	Never	Once	2 times	3 times	4 times or more
A. Hit you?	0	1	2	3	4
B. Kicked you?	0	1	2	3	4
C. Pushed you?	0	1	2	3	4
D. Hurt you?	0	1	2	3	4
E. Threatened you with a knife or sharp object?	0	1	2	3	4
F. Attacked with a knife or sharp object?	0	1	2	3	4
G. Threatened with a gun?	0	1	2	3	4
H. Shot at you with a gun?	0	1	2	3	4
I. Abused you verbally or emotionally (you were told something that made you feel bad)?	0	1	2	3	4
J. Stolen from you?	0	1	2	3	4

# Violence Perpetration Scale

¿En tu casa, colonia, o escuela, cuantas veces <u>en tu</u> <u>vida</u> has hecho estas cosas?	Nunca	Una vez	2 veces	3 veces	4 o más veces
A. Golpeado a otra persona	0	1	2	3	4
B. Pateado a otra persona	0	1	2	3	4
C. Empujado a otra persona	0	1	2	3	4
D. Lastimado a otra persona	0	1	2	3	4
E. Amenazado a otra persona con un cuchillo o un objeto afilado	0	1	2	3	4
F. Atacado a otra persona con un cuchillo o un objeto afilado	0	1	2	3	4
G. Amenazado a otra persona con una pistola	0	1	2	3	4
H. Disparado una pistola hacia alguien	0	1	2	3	4
I. Abusado verbalmente o emocionalmente a otra persona (has dicho algo para hacerles sentirse mal)	0	1	2	3	4
J. Robado a otra persona	0	1	2	3	4

In your home, neighborhood, or school, how many times in your life have you done these things?	Never	Once	2 times	3 times	4 times or more
A. Hit another person	0	1	2	3	4
B. Kicked another person	0	1	2	3	4
C. Pushed another person	0	1	2	3	4
D. Hurt another person	0	1	2	3	4
E. Threatened another person with a knife or sharp object	0	1	2	3	4
F. Attacked another person with a knife or sharp object	0	1	2	3	4
G. Threatened another person with a gun	0	1	2	3	4
H. Shot a gun at someone	0	1	2	3	4
I. Verbally or emotionally abused another person (you said something to make them feel bad)	0	1	2	3	4
J. Stolen from another person	0	1	2	3	4

#### APPENDIX D

### IRB APPROVAL



## APPROVAL: MODIFICATION

Flavio Marsiglia Global Center for Applied Health Research (GCAHR) 602/496-3333 marsiglia@asu.edu

Dear Flavio Marsiglia:

On 8/6/2019 the ASU IRB reviewed the following protocol:

Type of Review:	Modification/Update
Title:	keepin' it REAL in a Mexico Multi-site Study:
	Secondary data analysis
	of a longitudinal implementation
Investigator:	Flavio Marsiglia
IRB ID:	STUDY00001095
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Subagreement with UANL, Category: Other (to
	reflect anything not captured above);
	Comparison Group Post Test, Category: Measures
	(Survey questions/Interview questions /interview
	guides/focus group questions);
	• Monterrey Commitment Letter_12 2013.pdf,
	Category: IRB Protocol;
	• Experimental Group Post Test, Category: Measures
	(Survey questions/Interview questions /interview
	guides/focus group questions);
	• Subagreement with IMEG, Category: Other (to
	reflect anything not captured above);
	• R01 Mexico support letter Mora Medina.pdf,
	Category: IRB Protocol;
	• R01 mexico support letter IAPA 2.pdf, Category:
	IRB Protocol;
	• Marsiglia_MX Multi-site Application_REV2.docx,
	Category: IRB Protocol;
	• Jovenes cuestionario_Pre.pdf, Category: Measures
	(Survey questions/Interview questions /interview

The IRB approved the modification.

When consent is appropriate, you must use final, watermarked versions available under the "Documents" tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Stephanie Ayers Angela Benson Kevin Parkinson Dania Alcala-Calvillo David ALARCON RUBIO Amber Wutich Stacey Agustin Moran Stephen Kulis Marvyn Arevalo Avalos Jose Rosales Chavez Stephanie Ayers