

# Stress and Multiple Substance Use Behaviors Among Hispanic Adolescents

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Published online: 30 August 2015  
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**Abstract** Hispanic adolescents reported a higher annual prevalence of use of nearly all major drugs compared to non-Hispanic White and African American adolescents. Cultural or minority stressors, such as those related to the acculturation process, discrimination, immigration, poverty, and community violence, have been implicated in these outcomes. Unfortunately, few studies have examined how these stressors may have a differential or additive effect when considered simultaneously. The current study examined the relation between stress and multiple substance use behaviors in a sample of Hispanic adolescents ( $n=1036$ ), age 11–19 years old. Latent class analysis identified subgroups of Hispanic adolescents based on combinations of substance use behaviors. General linear models were used to examine mean differences by class among the eight domains of stress. Fit statistics revealed a six-class structure: no substance use risk, predominately alcohol use, low polysubstance use, high polysubstance use, illicit drug use, and predominately marijuana use. Differences in stress across the six classes were identified for four of the eight domains: family economic, acculturation gap, community and gang, and family and drug stress. The effect sizes revealed the largest mean differences in stress between the no substance use group and the two polysubstance use groups and between the no risk group and

alcohol use group. The findings from this study support the use of interventions that target stress to affect multiple substance use behaviors in Hispanic adolescents.

**Keywords** Stress · Hispanic adolescents · Multiple substance use behaviors

By 2050, one third of the 97 million Hispanics living in the USA will be younger than 19 years of age (US Department of Health and Human Services 2001). Hispanic adolescents face a disproportionately high risk of substance-use-related problems, especially due to early patterns of use. Hispanic youth have a higher annual prevalence of nearly all major drugs compared to their non-Hispanic White and African American peers (Johnston et al. 2015). By the time they reach 12th grade, they report higher annual use in some but not all of the major categories. The annual prevalence is higher for Hispanic youth compared that for non-Hispanic White and African American youth regarding marijuana (39.2, 35.6, and 35.0 %, respectively), inhalants (3.7, 2.6, and 2.0 %), ecstasy (4.5, 4.0, and 1.1 %), salvia (4.8, 3.8, and 2.6 %), cocaine (3.4, 3.1, and 0.9 %), crack (1.7, 1.0, and 0.9 %), Vicodin (7.1, 6.6, and 3.2 %), methamphetamines (1.2, 0.9, and 0.4 %), and crystal methamphetamine (2.1, 0.7, and 0.8 %; Johnston et al. 2015).

The prevalence of alcohol and tobacco use also raises significant concern (Johnston et al. 2015). Hispanic youth in 8th grade reported the highest frequency of binge drinking compared to non-Hispanic White and African American youth (7.8, 4.2, and 4.5 %, respectively) and in the 12th grade the highest 30-day prevalence of alcohol use (17.5, 10.7, and 10.0 %, respectively). This is particularly alarming given that Latino men experience higher rates of heavy and episodic drinking, which contribute to disproportionate alcohol-

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related problems such as HIV infection and cirrhosis of the liver (National Institute on Alcohol Abuse and Alcoholism 2013). Related to tobacco use, national trends have suggested that Hispanics have the lowest rates of tobacco-related cancers, such as lung and oral cavity cancers (American Cancer Society 2015). Yet, in the Monitoring the Future Study (Johnston et al. 2015), 24.2 % of 12th-grade Hispanic youth reported smoking cigarettes—slightly less than their non-Hispanic White peers (33.2 %) but higher than their non-Hispanic African American peers (9.5 %). Given that smoking is the leading cause of preventable deaths (American Cancer Society 2015), more preventive measures are needed to target cigarette and other forms of tobacco use in Hispanic youth.

### A Risk-Centered Approach to Adolescent Substance Use Prevention

A risk-centered approach aims to identify high-risk groups and inform the content and timing of preventive interventions to delay the onset of substance use behavior and prevent chronic conditions in adult life (Dierker et al. 2004). Some researchers have argued that a risk-centered approach to prevention is needed to address multiple behaviors that contribute to disease (Appleyard et al. 2005; Dierker et al. 2004; Hale et al. 2014). Risk factors are often mutually predictive of tobacco, alcohol, illicit drug use, and high-risk sexual behavior (Hale et al. 2014). Yet research has typically focused on identifying the impact of a set of factors on a single outcome. Although not all Hispanic adolescents use or abuse tobacco, alcohol, drugs, or some combination, approaches that identify “constellations of risk factors that show correlations to substance use may yield more meaningful distinctions,” which can then be used to target preventive intervention efforts with these high-risk groups (Dierker et al. 2004, p. 170).

The use of data-driven approaches has been implemented to identify subgroups (or clusters) based on risk profiles rather than demographic characteristics, such as age, gender, race, and ethnicity (Dierker et al. 2004; Prado et al. 2009). Identifying subgroups of Hispanic adolescents by their relative risk profiles rather than basic demographic differences across groups (e.g., Mexican vs Cuban) may be more useful for future prevention efforts because risk and protective factors are more responsive to intervention, whereas demographic characteristics are not (Prado et al. 2009). The latter approach also assumes that country of origin and nativity account for the observed differences in substance abuse when it is more likely that stress, family functioning, and drug norms play a greater role than demographics (Prado et al. 2009).

### Stress and US Hispanics

The stress–illness paradigm (Lazarus and Folkman 1984) suggests that individuals who experience chronic stress often report worse mental and physical health outcomes than individuals who report fewer stressors (Jackson et al. 2010). These findings are important in the context of racial and ethnic disparities in health because minorities often report more exposure to chronic and acute stress than do non-Hispanic Whites (Jackson et al. 2010). Among Hispanics, experiences of stress may be related to identification or perceived identification with a socially marginalized group (González-Guarda et al. 2012). Cervantes et al. (2012) identified eight domains of stress among Hispanic adolescents that broadly describe cultural-related stressors, such as acculturative gap stress, immigration stress, and discrimination, and social stressors, such as negative experiences in the educational system, economic hardship, substance use, and community and gang violence (Cervantes et al. 2012; Morales et al. 2002). Although social stressors are not unique to racial and ethnic minority groups, these communities are disproportionately affected because of histories of institutionalized racism, oppression, and residential segregation (Bulatao and Anderson 2004).

There is a growing body of research focused on identifying cultural and minority stressors and their association with mental health and substance abuse outcomes among Hispanic youth (Cervantes et al. 2012; Prado et al. 2009, 2013; Schwartz et al. 2013; Unger et al. 2014). Youth who report higher stress are significantly more likely to report internalizing and externalizing behaviors (Cervantes et al. 2015), including suicidal ideation (Cervantes et al. 2014). Similarly, discrimination, negative experiences in the USA post-immigration, and bicultural stress among Hispanic immigrant youth have been associated with lower self-esteem and increased depressive symptoms, aggressive behavior, and rule breaking (Schwartz et al. 2013). Higher levels of discrimination among high school youth was associated with higher cigarette, alcohol, and marijuana use in young adulthood, although Hispanic background was a protective factor for the use of these three substances (Unger et al. 2014).

Although previous research has been effective in identifying the influence of cultural and minority stressors on a single health outcome or risk behavior, more research is needed to identify how these stressors influence constellations of risk behaviors among Hispanic adolescents. Drawing from the stress–illness framework, the present study applied a data-driven approach to identify subgroups of Hispanic adolescents based on risk measures including alcohol, tobacco, marijuana, and illicit drug use to determine how adolescent subgroups classified by risky behavior differed on eight domains of stress, as measured by the Hispanic Stress Inventory–Adolescent Version (HSI-A). Identifying subgroups based on co-occurring risk behaviors and determining how these

subgroups differ in terms of stress experiences may provide a framework for developing effective interventions programs aimed at reducing these disparities among Hispanic adolescents that can address multiple risks and are perhaps more cost-effective (Ickovics 2008). Building on previous research, we asked the following research questions: (a) What are the latent classes of adolescent substance behavior among Latinos? (b) How do these latent classes of substance behavior differ in terms of the eight domains of cultural and minority stressors according to the HSI-A?

## Methods

### Sample

Data from the current study were drawn from a non-clinical school sample of 1036 adolescents from four urban US cities: Los Angeles ( $n=471$ ), Miami ( $n=209$ ), El Paso ( $n=92$ ), and Boston ( $n=264$ ).<sup>1</sup> Adolescents were recruited from middle schools and high schools to participate in a National Institute of Mental Health–funded validation study of a stress measure, the HSI-A (Cervantes et al. 2012). Random classroom sampling was conducted in middle and high school settings. The sampling frame included middle and high schools in which Latino adolescents represented at least 50 % of the student population. Classroom rosters were separated by grade level, 6th through 12th grades. Classrooms at each school were randomly selected to participate in the study. Information on the number of youth in each class and the percentage of those that returned a parental consent form was not collected. As a consequence, the response rate for the sample is unknown. Additionally, data on socioeconomic status was not collected directly from students; however, students were sampled from schools in which more than 50 % of youth qualified for free or reduced-price lunch.

Participants were given the option to complete the survey instrument in their preferred language (English or Spanish) using paper-and-pencil booklets. Only 2.0 % of the final sample completed the survey in Spanish. The final sample included youth of Mexican (47.5 %), Dominican (13.7 %), Cuban (12.1 %), mixed (8.8 %), Puerto Rican (7.7 %), Central American (5.5 %), South American (3.5 %), and other (1.5 %) origin. The majority of youth in the sample were born in the USA (75 %). A little more than half of the youth were female (55 %) and the average age was about 15 years old.

<sup>1</sup> The original study sample included 1279 individuals. During the validation study, participants were excluded from the analysis if they had more than 10 % missing data, generating a sample of 1037. One additional individual was excluded due to being 20 years of age.

## Measures

**Hispanic Stress Inventory** The dependent variable was an indicator of stress, as measured by the HSI-A, that is ecologically valid among Hispanic youth. Cervantes et al. (2012) developed the HSI-A in two stages. The first stage involved conducting 25 focus groups in 2007–2008 with 170 Hispanic youth from middle and high schools (mean age=14.8). The focus group protocol included open-ended questions relating to six broad areas of inquiry: immigration stress, communication and language stress, school and academic stress, peer and intimate relationship stress, family stress, and social and economic stress. These focus groups generated 160 short statements representing the life event stressors most salient in the adolescent narratives. Items were developed and assigned to one of the six areas of inquiry by experts in the mental health field. Kappa index coefficients were computed to determine interrater agreement between coders (Cervantes et al. 2012).

The second stage of psychometric development occurred in 2009 and involved administering the preliminary HSI-A measure to Hispanic adolescents in four US urban cities. Participants were asked if they had been exposed to a particular stressor (*yes* or *no*). If the participants answered affirmatively, they were asked to appraise the stressor using a five-point Likert scale, 1 = *not at all worried or tense* to 5 = *extremely worried or tense*. A composite score was computed that included both exposure and appraisal responses, ranging from 1 to 5. The measure combined negative responses to the exposure questions with appraisal scores of 1 (not at all worried or tense) to maintain sample size.

The psychometric properties of the HSI-A measure were tested in a sample of 992 Hispanic youth using factor analysis. The final measure included 71 items with eight unique subscales: family economic, cultural and educational, acculturation gap, immigration, discrimination, family immigration, community and gang, and family and drug stress. Stress domains of acculturative gap (“Parents want me to maintain customs and traditions,” “Expected to be like parent to siblings”), cultural and education (“Teachers think I am cheating when I am speaking in Spanish,” “School ignored cultural history”), discrimination (“Students said racist things,” “Pointed at and called me names”), immigration (“Left close friends in home country,” “Separated from some family members”), and family immigration (“Family afraid of getting caught by immigration officials,” “Family had problems with immigration papers”) relate specifically to Hispanic youth. The remaining domains, family economic (“Parents could not get a good job,” “Not enough money for everyone in the family”), community and gang (“I have a lot of pressure to be involved in gangs,” “Saw weapons at school”), and family and drug stress (“Family members had a drug problem,” “Hard to speak with family”), capture social stressors that are often experienced by Hispanics in the USA. Construct

validity was examined by calculating the Pearson's correlation between the HSI-A and the Child Depression Inventory and between the HSI-A and the Youth Self-Report Survey. The HSI-A was positively correlated with the Youth Self-Report Survey total score ( $r=.41, p<.001$ ) and the Child Depression Inventory total score ( $r=.41, p<.001$ ; for more information, see Cervantes et al. 2012). Internal consistency scores for the subscales in the sample ranged from  $\alpha=.64$  to  $.85$ . Higher scores reflect greater stress experiences.

**Substance Use Behaviors** Substance use behaviors were operationalized using seven categorical variables, including alcohol use, alcohol risk, marijuana use, marijuana risk, illicit drug use, and tobacco use. Questions related to substance use were taken from a survey tool implemented as part of a cross-site evaluation by the Substance Abuse and Mental Health Service Administration's (SAMHSA) Participant Outcome Measures for Discretionary Programs (SAMHSA 2003) as part of the Government Performance and Results Act. This evaluation asked adolescents about the number of times during the previous 30 days they used a particular substance.

Two separate variables for alcohol and drug use were included in the analysis. The first alcohol variable was a dichotomous single-item question: "In the past 30 days, did you use alcohol?" The second variable, alcohol risk, was also derived from a single-item question: "In the past 30 days, how many times did you use alcohol?" For alcohol risk, we constructed a three-level variable representing no alcohol use (0 times), low use (1–3 times), and heavy use (4 or more times) during the previous 30 days. Similarly, two marijuana use variables were constructed. Participants were asked a single-item dichotomous question about marijuana use (*yes* or *no*). Marijuana risk was assessed using a follow-up question, "In the past 30 days, how many times did you use marijuana?" and was operationalized as no use (0 times), low use (1–3 times), and heavy use (4 or more times) during the previous 30 days. The dichotomous use variable and the frequency of use variable regarding both alcohol and marijuana use were included in the study to account for missing data. For example, several participants endorsed using marijuana but did not report their frequency of use; similarly, some participants indicated using marijuana 1–3 times during the previous 30 days but did not answer the dichotomous question regarding use.

Illicit drug use was constructed based on several questions from the SAMHSA (2003) measure concerning the use of crack, heroin, methadone, speed, downers, PCP, ecstasy, LSD, other hallucinogens, inhalants, steroids, and other drugs during the previous 30 days. The frequency of use of these drugs was very low in our sample. As such, we constructed a dichotomous variable representing adolescents who endorsed one or more of the aforementioned drugs versus those who did not. Tobacco use was determined using a single question asking about frequency of smoking, chewing, or sniffing tobacco

during the previous 30 days. Response options were *no use*, *some use*, and *frequent use*.

**Covariates** Based on previous literature, we identified several covariates potentially associated with substance use behaviors, including parental nativity (US-born versus foreign-born), child age (continuous), child gender (male vs female), child nativity (US-born vs foreign-born), race (non-White vs White), and Hispanic origin.

## Data Analysis

To address the first research question (What are the latent classes of adolescent risk behavior?), we used latent class analysis (LCA) to identify subgroups (or classes) of individuals based on substance use behaviors (alcohol, marijuana, tobacco, and illicit drug use). LCA is a person-centered approach that identifies subgroups of individuals based on combinations of selected variables. In general, participants in the same class have similar patterns of behaviors. LCA involves specifying the number of classes and using model fit statistics to evaluate the goodness of fit of each model compared to the competing models (Lanza and Rhoades 2013). In the current study, we considered models with two, three, four, five, and six classes. The Vuong–Lo–Mendell–Rubin likelihood ratio test was used to compare how many classes of substance use behavior were represented in the data. LCA analyses were conducted using Mplus software. For most variables, approximately 6 % of data were missing, with the exception of tobacco use, which had approximately 17 % missing data. Missing data were addressed in Mplus using full information maximum likelihood with robust standard errors (Muthén and Muthén 2010).

To address the second research question (How do these latent classes of risk behavior differ in terms of the eight domains of stress?), we conducted a series of general linear models (GLMs) in SAS. Controlling for covariates, these GLMs compared the latent classes of substance use regarding the eight domains of stress. The Benjamini–Hochberg procedure adjusted for the false discovery rate of multiple pairwise comparisons at  $p=.05$ . Least squares means were calculated, accounting for the variability of appropriate covariates, and the effect sizes of the unstandardized coefficients were computed by dividing the coefficient by the root mean square error.

## Results

Table 1 reports the demographic characteristics of the sample. Roughly 75 % of youth in the sample were born in the USA; thus, the majority were second-generation residents. The majority reported having one or both parents born in Mexico, Latin America, or the Caribbean, and about 60 % of youth

**Table 1** Demographic characteristics and key variables in the Hispanic Stress Inventory–Adolescent Version sample

	<i>M (SD) or n (%)</i>
Age	14.80 (1.83)
Female	573 (55.5)
Foreign-born	156 (15.1)
Primary language	
English	712 (70.2)
Spanish	269 (26.5)
Other	33 (3.3)
HSI-A stress domains <sup>a</sup>	
Family economic	1.23 (0.46)
Culture and education	1.09 (0.24)
Acculturation gap	1.34 (0.50)
Immigration	1.17 (0.47)
Discrimination	1.14 (0.41)
Family immigration	1.19 (0.46)
Community and gang	1.20 (0.39)
Family and drug	1.25 (0.49)
Alcohol use during previous 30 days	
0 times	737 (79.7)
1–3 times	123 (13.3)
4 or more times	65 (7.0)
Marijuana use during previous 30 days	
0 times	880 (90.0)
1–3 times	57 (5.8)
4 or more times	41 (4.2)
Illicit drug use	82 (8.4)
Tobacco use during previous 30 days	
No use	795 (92.2)
Some use	47 (5.5)
Frequent use	20 (2.3)

<sup>a</sup> Responses ranked on a five-point Likert scale from 1 (not at all worried or tense) to 5 (extremely worried or tense).

lived in a two-parent household. Little information about socioeconomic status was collected from students. However, students responded to a question regarding the highest year of education their parents completed: no schooling (1.2 %), secondary school (14.6 %), some high school (20.3 %), completed high school (15.2 %), trade school (1.1 %), and college or postgraduate degree (38.3 %); 9.5 % ( $n=98$ ) had missing data.

Overall, youth in the sample reported low to moderate levels of stress across the eight domains. For substance use, the proportion of risk behaviors varied by type. For example, 24.4 % of the sample indicated using alcohol during the previous 30 days, whereas 10 % reported using marijuana, 8.4 % reported using illicit drugs, and 7.8 % reported tobacco use. Among those who reported using substances during the previous 30 days, the majority reported low to moderate use (1–3

times). Few adolescents in the sample reported high use: 7 % for alcohol, 4.2 % for marijuana, and 2.3 % for tobacco.

### Identification and Interpretation of Latent Classes

LCA was conducted in Mplus. Using the Vuong–Lo–Mendell–Rubin likelihood ratio test, we found that a five-class solution fit the data significantly better than a four-class solution,  $\chi^2(10)=23.169$ ;  $p=.009$ ; a six-class solution fit significantly better than five-class solution,  $\chi^2(10)=189.06$ ;  $p<.001$ ; and a seven-class solution did not fit significantly better than six-class solution,  $\chi^2(9)=10.28$ ;  $p=.328$ . Therefore, we proceeded with interpretation of the six-class solution. The likelihood ratio chi-square test of fit for binary and ordered categorical outcomes was not significant,  $\chi^2(155)=37.283$ ;  $p>.999$ , indicating good fit for the model. Also, the likelihood ratio chi-square for data missing completely at random under the unrestricted latent class indicator model was not significant,  $\chi^2(347)=286.627$ ;  $p=.992$ , suggesting that data could be assumed to be missing at random.

Table 2, provides the proportions of the risk behaviors in each of the six latent classes. The largest subgroup of adolescents in the sample was the no risk group, which we referred to as class 6. This class featured 692 adolescents, roughly 71 % of the sample, who did not engage in substance risk behaviors. However, approximately 2 % of the no risk class reported some or frequent tobacco use. They had the lowest proportion of all risk behaviors in the sample. Among youth who reported some risk behaviors, LCA identified distinct patterns of substance use behaviors, which are described below in order of subsample size.

Class 4, predominately alcohol use, had the largest sample size ( $n=160$ ) after the no risk group. In class 4, all youth reported some alcohol use; 76 % reported using 1–3 times and 24 % reported using 4 or more times during the previous 30 days. Youth who reported mostly alcohol use (class 4) comprised 55 % of the 286 youth who reported some substance risk behavior in the sample. Class 3 (predominately marijuana use) and class 4 (predominately alcohol use) reported similar proportions of illicit drug use (12 %) and low tobacco use (9 and 11 %, respectively). Adolescents in class 4 had similar proportions of alcohol use as those in class 5 (low polysubstance use), although youth who reported high polysubstance use (class 1) were more likely to report using 4 or more times during the previous 30 days than any other class (38 % in class 5 compared to 75 % in class 1).

Adolescents in class 1 ( $n=40$ ) and class 5 ( $n=41$ ) had roughly the same sample size. Adolescents in class 1 demonstrated high polysubstance use as evidenced by 100 % alcohol use (25 % low use and 75 % high use), 100 % high marijuana use, 67 % illicit drug use, and 65 % tobacco use (31 % low and 34 % high use). Although there were only 40 adolescents in

**Table 2** Proportion of substance use behavior by latent class

	Class 6 No risk <i>n</i> =692	Class 4 Alcohol use <i>n</i> =160	Class 5 Low polysubstance use <i>n</i> =41	Class 1 High polysubstance use <i>n</i> =40	Class 2 Illicit drug use <i>n</i> =28	Class 3 Marijuana use <i>n</i> =17
<b>Alcohol</b>						
Low use	0 %	76 %	62 %	25 %	0 %	0 %
High use	0 %	24 %	38 %	75 %	0 %	0 %
<b>Tobacco</b>						
Low use	1 %	11 %	24 %	31 %	23 %	9 %
High use	1 %	1 %	4 %	34 %	4 %	0 %
<b>Marijuana</b>						
Low use	0 %	0 %	80 %	0 %	0 %	76 %
High use	0 %	0 %	20 %	100 %	0 %	24 %
Illicit drug use	0 %	12 %	21 %	67 %	98 %	11 %

this subgroup, this was the most high-risk group in this study. LCA identified a second group of polysubstance users (class 5). In class 5, adolescents reported using multiple substances, but the frequency of use was much lower than in class 1. For example, in class 1, 100 % reported high marijuana and 75 % high alcohol use, compared to 20 and 38 %, respectively, in class 5. Illicit drug use was three times higher in class 1 (67 %) than in class 5 (21 %), as was the frequency of smoking, sniffing, or chewing tobacco (34 % in class 1 vs 11 % in class 5). Combining classes 1 and 5 initially seemed to make sense conceptually because both classes engaged in polysubstance use behaviors. However, differences in the frequency of polysubstance use between the two classes and evidence that a six-class solution had a better model fit provided support to distinguish between high and low polysubstance use classes.

Class 2 (predominately illicit drug use) and class 3 (predominately marijuana use) were the smallest risk classes. In class 2 (*n*=28), 98 % of adolescents reported illicit drug use and about 28 % reported some tobacco use, although only 4 % reported frequent use of tobacco. Adolescents in class 1 (high polysubstance users) and class 5 (low polysubstance use) were

distinct from those in class 2 (predominately illicit drug users) in that the former two classes reported moderate to high alcohol and marijuana use, whereas the latter class reported no use of alcohol or marijuana. Class 3 was the smallest subgroup (*n*=17) and featured youth who predominately reported marijuana use. All adolescents indicated some marijuana use; 76 % reported using 1–3 times and 24 % reported using 4 or more times during the previous 30 days. In addition to marijuana use, some youth reported tobacco and illicit drug use. Roughly 9 % of adolescents in class 3 used tobacco at the low end of the threshold, whereas 12 % reported some illicit drug use. Patterns of marijuana use among adolescents in class 3 were similar to those in class 5 (low polysubstance use), whereas more frequent marijuana use was most prevalent in class 1 (high polysubstance) compared to that in class 3 and class 5. Additionally, youth who used marijuana did not use alcohol, in contrast to youth in both polysubstance groups.

**Differences in Stress by Latent Class**

Table 3 shows mean scores on the HSI-A subscales by latent classes of substance use behavior. Differences in means were

**Table 3** Stress domain subscale means by latent class of substance use behavior after controlling for gender

	Class 6 No risk <i>n</i> =692	Class 4 Alcohol use <i>n</i> =160	Class 5 Low polysubstance use <i>n</i> =41	Class 1 High polysubstance use <i>n</i> =40	Class 2 Illicit drug use <i>n</i> =28	Class 3 Marijuana use <i>n</i> =17
Family economic	14.34	15.56	15.66	16.98	15.03	15.64
Culture and education	15.08	15.51	15.61	16.03	16.01	14.38
Acculturation gap	15.24	17.86	18.09	17.92	15.85	17.23
Immigration	8.26	8.14	7.68	7.66	8.59	7.86
Discrimination	6.73	7.16	7.12	7.74	6.50	6.41
Family immigration	8.19	8.69	8.65	7.94	9.29	8.89
Community and gang	9.24	10.26	10.37	11.43	10.10	10.36
Family and drug	5.90	6.94	8.16	7.38	7.26	6.45

tested using GLMs. Child gender, age, and Hispanic origin were originally included in the models as covariates. Child age and Hispanic origin were unrelated to the outcomes and were therefore excluded in the final models. Similarly, parental nativity and child race were excluded from the final models because they were not significantly related to the latent classes. As such, all final analyses controlled for adolescent gender. To interpret individual differences by group, the class variable needed to be significant in the overall model. The class variable was significant in four of the eight domains: family economic stress ( $F=2.97$ ,  $p=.011$ ), acculturative gap stress ( $F=7.42$ ,  $p<.001$ ), community and gang stress ( $F=7.11$ ,  $p<.001$ ), and family and drug stress ( $F=13.43$ ,  $p<.001$ ). The class variable was also significant for the total HSI-A scale ( $F=6.35$ ,  $p<.001$ ). Pairwise combinations were compared by converting the unstandardized estimates into effect sizes and adjusting for multiple test comparisons using the Benjamini–Hochberg test.

Table 4 presents the results from the significant tests and effect sizes of pairwise comparisons between latent classes. For the family economic stress domain, significant mean differences were observed in 1 of the 15 pairwise comparisons. The high polysubstance users (class 1) had significantly higher family economic stress than adolescents in the no risk group (class 6). The effect size was .47, suggesting a moderate effect size according to Cohen's  $d$ , after controlling for the effects of gender.

Significant mean differences were observed in 3 of the 15 pairwise comparisons on the acculturative gap stress subscale. The polysubstance users (class 1) had significantly higher

acculturation gap stress than adolescents in the no risk group (class 6). The effect size was .45, suggesting a moderate effect after controlling for gender. Significant mean differences in acculturative gap stress were found between class 4 (predominately alcohol use) and class 6 (no risk) and between class 5 (low polysubstance use) and class 6, with classes 4 and 5 showing greater stress than Class 6.

Mean differences by class were observed in two of the pairwise comparisons regarding community and gang stress. There were significant mean differences in community and gang stress among adolescents reporting high polysubstance use (class 1) compared to adolescents in the no risk group. The difference in means demonstrated a large effect (.71), with higher community and gang stress found among adolescents who indicated higher polysubstance use compared to adolescents who reported no risk behavior. Mean differences in community and gang stress were also observed among adolescents who reported frequent alcohol use (class 4) compared to adolescents who reported no risk behaviors. This difference demonstrated a small to moderate effect (.33), with adolescents in class 4 demonstrating higher stress.

There were significant differences in family and drug stress by class. The differences were observed in 5 of the 15 comparisons. First, adolescents in the high polysubstance group (class 1) reported significantly higher stress than adolescents in the no risk group (class 6), with a strong effect size of .61. As expected, adolescents in class 2 (predominately illicit drug use) had significantly higher mean scores on the family and drug stress subscale than the no risk group, with strong effect size of .56. However, the effect was slightly smaller than that

**Table 4** Significance tests and effect sizes of pairwise comparisons between latent classes

	Family and economic	Acculturation gap	Community and gang	Family and drug
Class 1 versus class 2	.35	.35	.43	.05
Class 1 versus class 3	.24	.11	.34	.38
Class 1 versus class 4	.26	.01	.37	.18
Class 1 versus class 5	.24	-.02	.34	-.32
Class 1 versus class 6	.47*	.45*	.71*	.61*
Class 2 versus class 3	-.11	-.23	-.08	.33
Class 2 versus class 4	-.09	-.34	-.05	.13
Class 2 versus class 5	-.11	-.38	-.09	.37
Class 2 versus class 6	.12	.10	.28	.56*
Class 3 versus class 4	.01	-.10	.03	.20
Class 3 versus class 5	-.00	-.14	-.00	-.71
Class 3 versus class 6	.23	.33	.37	.22
Class 4 versus class 5	-.01	-.03	-.04	-.50*
Class 4 versus class 6	.22	.44*	.33*	.43*
Class 5 versus class 6	.24	.48*	.37	.93*

Class 1 = high polysubstance, class 2 = illicit drug, class 3 = predominately marijuana, class 4 = alcohol, class 5 = low polysubstance, class 6 = no substance

\*Significant after controlling for false discovery rate at  $p<.05$

observed between the high polysubstance use and no risk groups. Differences in family and drug stress were also observed between class 4 (predominately low alcohol use) and class 5 (low polysubstance use) and between class 4 and class 6 (no use). The effect sizes for these four comparisons were moderate ( $-.50$  and  $.43$ , respectively). The largest effect size was observed between classes 5 and Class 6 (.93), with adolescents in the low polysubstance use group reporting significantly higher stress than those in the no risk group.

## Discussion

Stress is a common element related to a wide range of risky behaviors. The present study extends our understanding of how discrete stress domains, ranging from acculturation gaps to community and gang stress, are related to substance use behaviors. About 30 % of the youth in the sample demonstrated some substance use behaviors, and LCA identified five distinct patterns of use: alcohol (class 4), low polysubstance (class 5), high polysubstance (class 1), illicit drug (class 2), and marijuana (class 3) use. Among these six subgroups (five substance use groups and a no risk group), mean differences were observed in four of the eight stress domain subscales of the HSI-A. Family economic stress, acculturative gap stress, community and gang exposure, and family and drug stress were important risk factors associated with multiple substance use behaviors, especially polysubstance and alcohol use. Research has consistently indicated that cumulative stress is a significant detriment to adolescent mental health and other co-occurring behavioral outcomes (Appleyard et al. 2005), and chronic stress in early life is a predictor of behavioral health disparities throughout the life course (Jackson et al. 2010).

Family-related stress domains, namely, acculturative gap and family and drug stress, were especially salient to polysubstance (low and high) and alcohol use in the current study. The process of acculturation during adolescence is more interactive and often occurs in multiple contexts, such as school, peer groups, and family. Adolescents often acculturate at a faster pace than their parents, typically because they are educated in US schools, learn English more fluently, and have more exposure to mainstream culture. When parents and adolescents acculturate at a difference pace, known as acculturative gap or differential acculturation, this can increase family conflict and decrease family cohesion (Hwang and Wood 2009; Szapocznik and Williams 2000). Differential acculturation has been associated with increased mental health problems (Vega et al. 1995), and findings from our study suggest that greater perceived differences in parent–child acculturation are related to higher polysubstance and alcohol use. These findings highlight the need for substance abuse prevention programs that include the family and feature a

component designed to increase parent–child communication about differential acculturation and how these stressors may contribute to greater family conflict and lower family functioning.

Class differences in drug and family stress produced the largest effect sizes in the sample. However, there was a possible confounding of drug and family stress, exposure to and availability of drugs, and substance use behaviors among youth. Adolescents with greater exposure to illicit drugs, marijuana, tobacco, and alcohol may have fewer negative attitudes regarding use and may have greater access to engage in substance use behavior than youth whose parents are abstinent. Parental monitoring is a deterrent to adolescent substance use (Yabiku et al. 2010) and can promote stronger personal norms against drug use (Macaulay et al. 2005). Parental monitoring and greater substance exposure are likely important factors that predict substance use among adolescents, and neither of these variables was collected as part of this study. As a consequence, it was not possible to assess the effects of poor parental monitoring and substance abuse exposure on adolescent use. Future research should integrate measures of stress, parental monitoring, and substance use exposure.

The importance of economic and community and gang stress in our study should not be overlooked. Our findings are aligned with previous research indicating a strong correlation among economic circumstances and crime, substance use, and other poor health outcomes (Galea and Vlahov 2002; Glaeser et al. 1996). Social and economic factors influence the risk behaviors and drug use patterns of individuals, and minority groups are disproportionately affected in large part due to long histories of oppression and segregation that put them at higher risk of poverty (Galea and Vlahov 2002). Alleviating these social conditions may change an individual's experience and ultimately decrease stress responses (Dickerson and Kemeny 2004).

For practitioners, our findings may inform direct service. There are several programs designed to address substance use in youth. Yet few trials have tested the efficacy of these approaches with Hispanic youth (Feldman et al. 2013). Among interventions that have been tested with Hispanic youth, few address multiple behaviors in this population and virtually no interventions target the stressors identified in this study. Hale and colleagues (2014) systematically reviewed nine biomedical and social science databases for randomized controlled trials targeting at least two of the following risk behaviors: tobacco, alcohol, and illicit drug use; sexual risk behavior; and aggressive behavior. Among the 55 studies that they reviewed, 45 studies were conducted in the USA and only two integrated a Hispanic-specific cultural component: Familias Unidas (Pantin et al. 2003, 2009) and keepin' it REAL (Kulis et al. 2005; Marsiglia et al. 2011). Although both had moderate to strong effect sizes (Hale et al. 2014), neither of these preventive interventions directly targeted the



stressors identified in the current study nor were they tailored based on the level of risk experienced by youth. The integration of ecological indicators of stress among Hispanic adolescents into intervention efforts may increase intervention effectiveness, be more culturally appropriate for youth, and decrease treatment dropout rates.

Although the current study had strengths, limitations associated with the research design, sample size, and measurement should be noted. The original study was a randomized classroom design and did not capture information on the number of youth in each class and the percentage of students who returned parental consent forms. One of the most significant study limitations is its cross-sectional design. Because we collected data at only one time point, we were not able to establish whether stress predicted substance use behaviors or these behaviors existed first and stress was a consequence of these risk patterns. Longitudinal data on stress experiences would allow examination of these constructs over time and an understanding of how these stressors in early life may influence risk behaviors throughout the life cycle. Additionally, sample sizes were small in the illicit drug use ( $n=28$ ) and the predominately marijuana use ( $n=17$ ) classes. This may have contributed to an underestimation of class differences across stress domains. Finally, youth who engage in illicit drug use were probably less likely to report to school.

There were several measures that were not included in the data collection process that would have strengthened the study. One such limitation was the exclusion of a strong measure of family socioeconomic status. Although we included proxy variables, such as parental employment status, these constructs did not capture family income, material and financial hardship, and food insecurity. These variables may be correlated to both risk behaviors and Hispanic stress domains measured by the HSI-A. Additionally, an initial goal of the paper was to include HIV and sexually transmitted infection risk behaviors. Research has documented the co-occurrence of substance use and HIV risk behavior among Hispanic adolescents (Pantin et al. 2009; Prado et al. 2009). The current study did not explore sexual risk, rather asking respondents only about teenage pregnancy. We considered using this as a proxy for sexual risk; however, the measure was problematic because adolescent boys were asked if their girlfriend had ever been pregnant, not if they had ever been involved in a pregnancy. Few individuals endorsed the pregnancy question in the sample ( $n=27$ , 2.6 %), and given the national rates of teenage pregnancy among Hispanic youth, sexual risk was not likely captured by the measure. Future research should examine cultural and minority stressors and HIV risk behavior.

Despite several limitations, this study provides a framework for understanding multiple risk behaviors among Hispanic adolescents. Research documenting multiple risk behaviors and the development of preventive interventions that

address stressors and these high-risk comorbidities are critical next steps to decreasing health disparities in this population. From a broader perspective, previous research (including the current study) has documented that Hispanic adolescents experience unique stressors beyond the normal strains of adolescence. Although our study found that three of the eight domains were particularly salient, there was an association between nearly all of the stress domains and multiple risk behaviors. Further, many Hispanic youth grow up in the USA and do not report poor outcomes in the long term. Thus, future research should not neglect the diverse set of stress experiences that these youth face each day, and should also seek to identify the important coping (cultural and otherwise) mechanisms that may help protect this growing segment of the US population from harm.

**Acknowledgments** The study was funded by the National Institute of Mental Health (2R44MH073180-02, PI: Richard C. Cervantes).

**Conflict of Interest** The authors declare that they have no conflict of interest.

**Statement of Human Rights** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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