

Smoking Experimentation, Moderate-to-Vigorous Physical Activity, and Associated Psychosocial and Demographic Correlates among Mexican Origin Youth

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Abstract: Moderate-to-vigorous physical activity (MVPA) may deter adolescents from smoking initiation and psychosocial risk and protective factors associated with both physical activity and smoking experimentation may play a role. This paper examines such psychosocial factors across four groups of adolescents identified by crossing smoking experimentation (yes/no) with completion of regular MVPA (yes/no). In 2008-09, 1,098 Mexican origin youth (553 girls and 546 boys, mean age 14.3 years [SD=1.04]) provided data on smoking behavior, physical activity, alcohol use, acculturation, peer and parental smoking, BMI, body image, smoking outcome expectations, anxiety, subjective social status (SSS), body image, and sensation-seeking tendencies. We conducted Pearson's χ^2 tests to examine associations between a) MVPA and smoking and b) demographic variables and the four groups identified by crossing smoking experimentation with MVPA. Next, adjusting for age and gender, we completed analysis of covariance to examine differences in psychosocial factors across the four groups. In our sample, 22.4% had experimented with cigarettes, and 29.3% completed adequate MVPA. Both behaviors were more prevalent among boys. Although not statistically significantly higher, 32.9% of experimenters completed adequate MVPA compared to 28.3% among non-experimenters. Experimenters who complete adequate MVPA reported the highest levels of thrill and adventure seeking, while those who completed inadequate MVPA reported lower SSS and more body image concerns than non-experimenters ($p < 0.05$ for all). Our findings highlight an opportunity to address MVPA as an alternative to smoking among Mexican origin youth with high thrill and adventure sensation-seeking tendencies, 82% of whom have experimented and 69% of whom completed MVPA.

Keywords: moderate-to-vigorous physical activity, smoking behavior, shared psychosocial correlates, Mexican origin youth.

INTRODUCTION

The risk of smoking initiation is highest during adolescence [1,2]. It is also a time when patterns of physical activity are likely to change, becoming less frequent than in pre-adolescence [3]. A decrease in physical activity may be particularly common among teen smokers, who are generally less physically active than their non-smoker counterparts [4]. Smoking and physical activity behaviors during adolescence are likely to track into adulthood, impacting risk for chronic disease and various cancers [5,6]. Evidence suggests that regular moderate-to-vigorous physical activity (MVPA), defined as being physically active for 60 minutes on at least 5 of the 7 previous days, may deter adolescents from both the initiation and continuation of smoking [7]. However to intervene

effectively, physical activity programs would require knowledge of how psychosocial risk factors differ across groups of youth with different levels of physical activity and cigarette experimentation experience, so as to identify characteristics of youth most and least at risk for these life-long health-related behaviors.

Engaging in physical activity may be connected to teens' perceptions of the activity and the feelings the activity elicits [8]. Our previous research on Mexican origin youth suggests similar motivations for smoking [9-11]. Those who experiment with cigarettes are likely to exhibit sensation-seeking tendencies, higher anxiety, worse body image, and lower subjective social status (SSS) [9-11]. They are also more likely to expect positive outcomes from smoking [9]. Smoking experimenters are also more likely to experiment with other substances, such as alcohol and other drugs [12,13]. Of note, higher levels of sensation-seeking tendencies, lower SSS, poor body image, and lower

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anxiety among Mexican origin youth are also associated with regular MVPA [14,15].

Most research, to date, has examined Hispanic youth as a group, but the study of the subgroup of Mexican origin youth is important because people of Mexican origin represent the largest and most rapidly growing subgroup of Hispanics in the United States [16]. Hispanics are the largest and most rapidly growing ethnic group in the United States and are from diverse ethnic backgrounds that are culturally distinct from each other [16-18]. We focus on the subgroup of Mexican origin youth in order to identify unique risk factors associated with a single subgroup of Hispanics. Hispanic youth in Texas, of whom Mexicans represent the majority, report higher rates of cigarette experimentation and lower rates of adequate physical activity compared to youth of other ethnic backgrounds [19]. For these reasons, studying smoking behavior and physical activity in this population with the goal of preventing smoking initiation, is timely and warranted.

Physical activity and smoking during adolescence occurs within a social context that can influence adolescents to engage in these behaviors. Mexican origin adolescents are more likely to try cigarettes if they have family members or friends who smoke [20,21]. Furthermore, physical activity was found to be most common among the least and most acculturated youth, compared to those of moderate acculturation [10]. No studies, however, have explored how these two behaviors and their intrapersonal and social environmental risk factors intersect among Mexican origin youth.

The acknowledgement of the association between physical activity and smoking has yielded intervention efforts in which the former is used, at times effectively, as part of smoking cessation programs for both adults and teens [22,23]. A similar approach may be beneficial to prevent smoking experimentation and continuation among adolescents. Therefore, in this paper we examine psychosocial differences among four groups of Mexican origin adolescents: physically active cigarette experimenters, physically active non-experimenters, non-physically active cigarette

experimenters, and non-physically active non-experimenters in order to identify characteristics of youth most and least at risk for tobacco use.

METHODS

Study Design

Participants in the current study are part of a prospective study of smoking behavior, and were recruited from a large population-based cohort of Mexican American households in the Houston metropolitan area launched in 2001 and maintained by the Department of Epidemiology at The University of Texas M.D. Anderson Cancer Center. Household members were recruited into the Mano-a-Mano Mexican American Cohort Study (MACS) using door-to-door recruitment, probability random-digit dialing, intercepts, and networking approaches. Analysis of the pooled recruitment methods revealed no significant differences between the sample and the census tract from which they were drawn, with respect to language preference, country of origin, years living in the US, and household income [24]. A detailed description of the cohort recruitment methods has been previously published [25].

Three thousand households with adolescents between the ages of 11 and 13 years were identified from the MACS database. Of the first 1,425 contacted, just over 90% of parents and legal guardians (N=1,328) provided written informed consent while the child provided written informed assent prior to enrolling in the study in 2005-06. The Institutional Review Board at The University of Texas M.D. Anderson Cancer Center granted approval for both the MACS and this study.

Data Collection

A personal digital assistant (PDA) survey was administered in 2005-06 and again in 2008-09, *via* personal interviews in the participants' homes, following data collection procedures that have been previously published [20]. Briefly, after a 5-minute interview in which demographic information was obtained, participants privately completed a survey on a PDA. Participants completed the survey in either English or Spanish and received a gift certificate (\$25) after each interview.

Measures

Outcome Measure

Our main outcome variable was a four-level categorical variable based on reported MVPA level and smoking experimentation status. The four categories were: adequate MVPA and non-experimenter; adequate MVPA and experimenter; inadequate MVPA and non-experimenter; and finally inadequate MVPA and experimenter.

Smoking experimentation was assessed by the PDA survey questions, “Have you ever smoked a whole cigarette?” and “Have you ever tried a cigarette, even a puff?” A response of yes to either item indicated experimentation. For this analysis, participants who reported no experience with tobacco were considered non-experimenters, and coded as ‘0’. Participants who reported having tried cigarettes, at least once, were considered experimenters and were coded as ‘1’.

MVPA was assessed using the following two survey items: “Think about the activities you do at school, but not in PE. On how many days, of the past 7, did you exercise or participate in physical activity for at least 60 minutes per day?” and “Think about activities you do in your community or at home. On how many days, of the past 7, did you exercise or participate in physical activity for at least 60 minutes per day?” both of which were adapted from the Youth Risk Behavioral Surveillance System [26]. To be consistent with 2005 guidelines for MVPA, using both variables and regardless of context, participants who reported being physically active for at least 60 minutes on at least 5 days, out of the previous 7, were considered to have adequate MVPA and coded as ‘0’. Others were considered to have inadequate MVPA and were coded as ‘1’.

Behavioral and Psychosocial Covariates

The behavioral and psychosocial covariates are described in Table 1.

Demographic Covariates

Participants reported their gender as either male or female, and their country of birth as either the United States or Mexico. Age was entered as a continuous variable. Socio-economic status (SES)

was assessed using highest parental educational attainment rather than household income. Both are valid markers of SES, but more than 40% of parents did not report income, while the majority reported educational attainment [27]. SES was categorized as less than high school, high school/General Educational Development equivalency, or more than high school. Body Mass Index (BMI) was calculated using the height and weight measurements taken by trained interviewers at follow-up in 2008-09. Seca scales and stadiometers were used following a standard protocol.

All variables in the current analysis were assessed at follow-up in 2008-09, with the exception of parental education, which was assessed when the parent enrolled in the MACS.

Statistical Analyses

For descriptive purposes, we calculated frequencies for gender, country of birth, parental education, MVPA, and smoking experimentation, while for age and the psychosocial correlates of interest, we calculated means and standard deviations. We conducted Pearson’s χ^2 tests to examine the association between MVPA and smoking experimentation, as well as the associations between gender, country of birth, and parental educational attainment, and the four-level categorical variable combining MVPA and smoking experimentation status. We used analysis of variance (ANOVA) to examine unadjusted mean differences in age by the four-level categorical variable. We used analysis of covariance (ANCOVA) to examine mean differences in the psychosocial correlates by the four-level categorical variable, adjusting for age and gender. Post-hoc comparisons of significant mean differences of the psychosocial correlates were completed and statistical significance was assessed using a Bonferroni adjustment to correct for the multiple comparisons.

RESULTS

Table 2 depicts the frequencies, means, and standard deviations of participant demographic characteristics, outcome variables, and the correlates of interest. The current analyses are based on 1,098 participants, or 95% of the 1,154 participants who provided data at follow-up in 2008-09,

Table 1: Psychosocial and Behavioral Traits Examined in Relation to Smoking Experimentation and Regular Completion of Moderate-to-Vigorous Physical Activity

Acculturation [41]	Assessed using four items that ascertain language used when reading, speaking at home, speaking with friends, and thinking. Responses are made on a five-point scale ranging from 'only Spanish' to 'only English'. Acculturation scores reflect the mean of the four items. Based on our data, the scale demonstrates excellent internal reliability ($\alpha=0.92$).
Social influence from friends and family	Parental influence on smoking was assessed using two questions: 'Does your father/stepfather smoke?' and 'Does your mother/stepmother smoke?' The variable reflects if none, one, or both parents smoke. Similarly, peer influence was assessed by asking: 'how many of your three closest friends smoke?' The variable reflects if none, one, or two or more friends smoke.
Positive outcome expectations [42]	Outcome expectations are the beliefs about the positive or negative consequences of engaging in a specific behavior [43]. Assessed using seven items. Responses for each item are made on a four-point scale that ranges from 'strongly disagree' to 'strongly agree'. Positive outcome expectation scores reflect the mean of the seven items, ranging from 1 to 7. The scale demonstrates very good internal reliability based on our data ($\alpha=0.88$).
Trait anxiety [44]	Trait anxiety refers to a relatively stable response or proneness to anxiety [40]. Assessed using 20 items. Response options range from 'not at all' to 'very much so' on a 4-point scale. Trait anxiety scores reflect the mean of the 20 items, ranging from 20 to 80. The scale has been validated in US Spanish-speaking samples; based on our data, the scale demonstrates very good internal reliability ($\alpha=0.86$) [45].
Subjective social status [46]	Participants place themselves on a 10-rung ladder, with higher rungs representing more positive perceptions of social status as it relates to grades in school, number of friends, and proficiency at sports.
Body Shape Questionnaire [47]	Body image was assessed using 10 items. Response options included 'no', 'not sure', or 'yes'. Each 'yes' was added to create a composite score, ranging from 0 to 10; higher scores reflect greater concern with body image. The scale demonstrates good internal reliability based on our data ($\alpha=0.70$).
Sensation Seeking Scale [48]	Sensation seeking is a personality trait that takes the form of seeking novel, varied, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks in order to experience this sensation [49]. Drug and alcohol seeking (DAS), social disinhibition, and thrill and adventure seeking (TAS) were assessed using subscales from a larger 26-item sensation seeking scale. Based on data from our participants, each scale demonstrated good internal reliability ($\alpha^{\text{DAS}}=0.72$; $\alpha^{\text{social disinhibition}}=0.68$; $\alpha^{\text{TAS}}=0.81$).
Team sports participation [26]	School team sports and community team sports participation were assessed using the following two items, both of which were adapted from the 2005 Youth Risk Behavioral Surveillance System (YRBSS): "Think about the activities you do at school but not during P.E. During the past 12 months, on how many sports teams did you play?" and "Think about the activities you do in your community or at home. During the past 12 months, on how many sports teams did you play?" Responses to both items were summed to reflect the total number of sports teams on which the participant played in the past 12 months.
Alcohol Use [26]	To assess alcohol use, participants were asked "During your life, on how many days have you had at least one drink of alcohol?" The item is taken directly from the 2005 YRBSS: Participants who reported 0 days of alcohol use were considered never-drinkers, while those who reported having tried alcohol at least once were considered ever-drinkers.

and for whom there were complete data for the variables of interest. The sample was nearly evenly split by gender, and ages ranged from 12-17 with a mean of 14.32 years ($SD=1.04$). US-born participants comprised nearly three-fourths of

the sample, and 65.3% had parents with less than a high school education. Overall, 22.4% of participants had experimented with cigarettes and 29.3% completed adequate MVPA.

Table 2: Participant Characteristics by Demographic Factors, Behaviors and Psychosocial Factors (N=1,098)

Demographic Factors	N (%)
Gender	
Female	553 (50.4)
Male	545 (49.6)
Age (Years)	
Mean (SD)	14.32 (1.04)
Range: 12-17	
Country of Birth	
Mexico	286 (26.0)
US	812 (74.0)
Parental Education	
< HS	717 (65.3)
HS	192 (17.5)
> HS	189 (17.2)
Behaviors	
MVPA	
Inadequate	776 (70.7)
Adequate	322 (29.3)
Smoking Experimentation	
Non-Experimenter	852 (77.6)
Experimenter	246 (22.4)
Psychosocial Factors	Mean (SD)
Acculturation	
Range: 1-5	3.50 (0.72)
No. Parents who Smoke	
Range: 0-2	0.37 (0.56)
No. Friends who Smoke	
Range: 0-3	0.34 (0.74)
BMI	
Range: 14.57-58.00	25.03 (6.33)
Community Team Sports	
Range: 0-7	1.49 (1.67)
School Team Sports	
Range: 0-7	1.71 (1.71)
Alcohol Use	
Range: 0-1	0.29 (0.46)
Smoking Outcome Expectations	
Range: 1-7	1.33 (0.48)
Trait Anxiety	
Range: 20-70	38.32 (9.44)
Subjective Social Status	
Range: 1-10	7.75 (1.49)
Body Image	
Range: 1-10	1.83 (2.25)

Drug & Alcohol Seeking	
Range: 0-7	1.13 (1.56)
Social Disinhibition	
Range: 0-7	3.27 (1.93)
Thrill & Adventure Seeking	
Range: 0-12	6.85 (3.30)

SD: standard deviation. Participants who reported being physically active for at least 60 minutes on at least 5 days were considered to have adequate MVPA; all others were considered to have inadequate MVPA. Participants who responded yes to either "Have you ever smoked a whole cigarette?" or "Have you ever tried a cigarette, even a puff?" were considered experimenters; participants who answered no to both questions were considered non-experimenters.

Table 3 shows the prevalence of smoking experimentation by MVPA status. Smoking experimentation did not differ significantly by MVPA ($p=0.159$). Among the non-experimenters, 28.3% completed adequate MVPA compared to 32.9% of experimenters. Further analyses examining mean differences in the demographic and psychosocial correlates by the four-level categorical variable yielded statistically significant results, which are presented in Tables 4 and 5. Regardless of smoking experimentation status, a higher proportion of boys, compared to girls, completed adequate MVPA ($p<0.001$). Among those with inadequate MVPA, a higher proportion of boys (18.7%) compared to girls (11.4%) had experimented with cigarettes ($p<0.001$). Girls were more likely than boys to neither have experimented with cigarettes nor complete adequate MVPA (66.2% vs. 45.0%). Regardless of level of MVPA, experimenters were older than non-experimenters ($p<0.001$). Regardless of smoking status, there were no significant differences in age between those with adequate and inadequate MVPA ($p=0.672$; data not shown).

In Table 5, we present gender- and age-adjusted means for the psychosocial correlates by the four-level categorical variable. Irrespective of MVPA level, experimenters reported more parents who smoked, and more friends who smoked, compared to non-experimenters ($p<0.05$ for all). Similarly, at both levels of MVPA, experimenters held more favorable outcome expectations (in other words, perceived more social benefits from smoking) associated with smoking than non-experimenters did ($p<0.05$) and more participants who had experimented with cigarettes had also

Table 3: Prevalence of Smoking Experimentation by Moderate-to-Vigorous Physical Activity (N=1,098)

MVPA	Smoking Status		Total	p-value
	Non-Experimenter N (%)	Experimenter N (%)		
Inadequate	611 (71.7)	165 (67.1)	776 (70.7)	0.159
Adequate	241 (28.3)	81 (32.9)	322 (29.3)	
Total	852 (77.6)	246 (22.4)	1,098	

Participants who reported being physically active for at least 60 minutes on at least 5 days were considered to have met requirements; all others were considered to not have met requirements. Participants who responded yes to either "Have you ever smoked a whole cigarette?" or "Have you ever tried a cigarette, even a puff?" were considered experimenters; participants who answered no to both questions were considered non-experimenters.

Table 4: Participant Characteristics by Moderate-to-Vigorous Physical Activity and Smoking Experimentation Status (N=1,098)

Demographics	MVPA and Smoking Experimentation Status				p-value
	Adequate MVPA & Non-Experimenter N (%)	Adequate MVPA & Experimenter N (%)	Inadequate MVPA & Non-Experimenter N (%)	Inadequate MVPA & Experimenter N (%)	
Overall	241 (21.9)	81 (7.4)	611 (55.7)	165 (15.0)	<0.001
Gender					
Female	100 (18.1)	24 (4.3)	366 (66.2)	63 (11.4)	<0.001
Male	141 (25.9)	57 (10.5)	245 (45.0)	102 (18.7)	
Age (Years)					0.059
Mean (SE)	14.15 (1.03) ^a	14.74 (0.92) ^b	14.16 (1.00) ^a	14.95 (0.98) ^b	
Country of Birth					0.739
Mexico	69 (24.1)	22 (7.7)	166 (58.0)	29 (10.1)	
US	172 (21.2)	59 (7.3)	445 (54.8)	136 (16.7)	
Parental Education					
< HS	150 (20.9)	48 (6.7)	406 (56.6)	113 (15.8)	
HS	45 (23.4)	16 (8.3)	104 (54.2)	27 (14.1)	
> HS	46 (24.3)	17 (9.0)	101 (53.4)	25 (13.2)	

Means with the same letters are not statistically significantly different from each other. Conversely, means with different letters are statically significantly different from each other.

used alcohol compared to those who had not smoked ($p < 0.05$).

Regarding sensation-seeking tendencies, experimenters, regardless of MVPA level, had higher scores on drug and alcohol seeking and social disinhibition than non-experimenters ($p < 0.05$ for all). Thrill and adventure-seeking scores were highest among participants who both completed adequate MVPA and had experimented ($p < 0.05$) compared to the other groups. Similarly, among those with inadequate MVPA, experimenters reported higher levels of thrill and adventure seeking than non-experimenters ($p < 0.05$). Experi-

menters had higher anxiety scores than non-experimenters, regardless of their MVPA levels ($p < 0.05$). Those who reported adequate MVPA, regardless of experimenter status, reported lower anxiety compared to those who were less active ($p < 0.05$).

Regardless of smoking status, participants with adequate MVPA participated in a higher number of both school and community sports teams than those who did not ($p < 0.05$ for both). Experimenters with inadequate MVPA reported lower SSS than non-experimenters irrespective of MVPA level ($p < 0.05$ for both) and reported more body

Table 5: Psychosocial Risk Factors by Moderate-to-Vigorous Physical Activity and Smoking Experimentation Status (N=1,098)

Correlate	MVPA and Smoking Experimentation Status				p-value
	Adequate MVPA & Non-experimenter Mean (SE)	Adequate MVPA & Experimenter Mean (SE)	Inadequate MVPA & Non-experimenter Mean (SE)	Inadequate MVPA & Experimenter Mean (SE)	
No. parents who smoke	0.33 (0.04) ^a	0.54 (0.06) ^b	0.32 (0.02) ^a	0.51 (0.05) ^b	<0.001
No. peers who smoke	0.27 (0.04) ^a	0.85 (0.08) ^b	0.19 (0.03) ^a	0.76 (0.06) ^b	<0.001
Outcome Expectations	1.22 (0.03) ^a	1.65 (0.05) ^b	1.25 (0.02) ^a	1.65 (0.04) ^b	<0.001
Alcohol Use	0.23 (0.03) ^a	0.57 (0.05) ^b	0.19 (0.02) ^a	0.61 (0.03) ^b	<0.001
Drug & Alcohol Seeking	0.89 (0.09) ^a	2.16 (0.16) ^b	0.79 (0.06) ^a	2.26 (0.11) ^b	<0.001
Social Disinhibition	3.27 (0.12) ^a	4.19 (0.20) ^b	2.93 (0.07) ^a	4.06 (0.15) ^b	<0.001
Thrill & Adventure Seeking	6.97 (0.20) ^{a,c}	8.56 (0.34) ^b	6.44 (0.12) ^a	7.36 (0.24) ^{a,c}	<0.001
Trait Anxiety	36.85 (0.60) ^a	40.50 (1.04) ^{b,c}	37.66 (0.38) ^{a,c}	41.85 (0.74) ^b	<0.001
Community Team Sports	2.20 (0.10) ^a	2.06 (0.18) ^a	1.18 (0.07) ^b	1.30 (0.13) ^b	<0.001
School Team Sports	2.21 (0.11) ^a	2.49 (0.19) ^a	1.44 (0.07) ^b	1.58 (0.13) ^b	<0.001
Subjective Social Status	7.95 (0.09) ^a	7.63 (0.16) ^{a,b}	7.85 (0.06) ^a	7.17 (0.12) ^{a,b}	<0.001
Body Image	1.58 (0.14) ^a	2.04 (0.25) ^{a,b}	1.76 (0.09) ^a	2.32 (0.18) ^{a,b}	0.009
Acculturation	3.52 (0.05) ^a	3.49 (0.08) ^a	3.49 (0.03) ^a	3.52 (0.06) ^a	0.921
BMI	24.75 (0.41) ^a	25.35 (0.71) ^a	25.05 (0.26) ^a	25.29 (0.51) ^a	0.819

SE: standard error. Means with the same letters are not statistically significantly different from each other. Conversely, means with different letters are statically significantly different from each other. Higher scores on the following scales reflect a stronger endorsement of the attribute assessed: positive outcome expectations from smoking, anxiety, subjective social status, body image concerns, drug and alcohol seeking, social disinhibition, thrill and adventure seeking.

image concerns than non-experimenters, regardless of MVPA level ($p < 0.05$).

Finally, we found neither acculturation nor BMI was significantly associated with the interaction of MVPA and smoking experimentation.

DISCUSSION

This study examined differences in smoking and physical activity-related psychosocial factors among four groups of Mexican origin adolescents stratified by combined physical activity and smoking-experimenter status. In our overall sample, 22.4% had experimented with cigarettes, and 29.3% reported adequate MVPA. Consistent with our previous research, boys were more likely than girls to complete adequate MVPA and experiment with cigarettes [10]. Among our Mexican origin participants, smoking experimentation rates did not differ significantly by level of MVPA, although more experimenters compared to non-experimenters completed adequate MVPA (33% vs. 28%, respectively).

Our results suggest that, with the exception of acculturation and BMI, the factors we examined differed significantly across the four groups of physical activity and smoking status. The most significant differences appear to be driven by smoking or physical activity, rather than a combination of the two. For example, as would be expected, completing adequate physical activity was associated with greater involvement in community and school sports [28]. Patterns in the remainder of the factors across groups suggest that smoking status, as opposed to physical activity, might be the main driving differentiator. For example, also as expected, experimenters reported higher means for parental and peer smoking influence, regardless of level of MVPA [29]. We did not observe differences in MVPA at either level of experimentation. A similar pattern was found for alcohol use, smoking expectations, as well as the drug and alcohol-seeking scales and social disinhibition sensation-seeking scales. All four factors have been found in previous work to be associ-

ated with tobacco use in this population [9,10,12,13].

Thrill and adventure seeking, much like the other sensation-seeking scales, differed by smoking and MVPA status. However, the highest levels of thrill and adventure seeking were in experimenters who completed adequate MVPA. This finding parallels previous research in which those with high thrill and adventure-seeking scores were more likely to express their sensation-seeking tendencies across a variety of behaviors, including physical activity and smoking [10,30].

For both SSS and body image, those who engaged in smoking experimentation and inadequate MVPA perceived they were lower on the social ladder and had a poorer body image compared to non-experimenters. These findings support previous research that suggests an association between smoking and low social status, both in the sample of our study and in other populations of adolescents [9,31]. They also parallel conclusions of previous studies in which poor body image was associated with smoking uptake and continuation, possibly as a means of weight control [11,32]. For body image particularly, it is notable that the mean for experimenters who completed adequate MVPA did not differ significantly from the other 3 groups. This suggests that among Mexican origin youth MVPA might not be a behavior used to ameliorate poor body image to the degree that it is used in other populations of adolescents [33].

Anxiety scores were higher among experimenters with inadequate levels of MVPA compared to non-experimenters, irrespective of their MVPA status. Among those with adequate MVPA, experimenters reported higher anxiety levels compared to non-experimenters. Together, these findings underscore the possibility that because anxiety levels are higher among experimenters than non-experimenters, smoking, more so than physical activity, is a behavior Mexican origin adolescents use to cope with anxiety. However, further research designed to decipher either active or subconscious choice in engaging in either behavior as a coping mechanism is needed to draw such a conclusion.

Overall, findings suggest that with the exception of team sports participation, differences among the variables examined in our study are driven primarily by smoking behavior. This finding is not unexpected, given that three of the variables we examined specifically focus on smoking (social influence and outcome expectations) and the other psychosocial factors have been found to be associated with smoking in previous studies. Thus among participants of the same smoking status, physical activity does not appear to confer notable protection from experimentation against the impact of peer and parental influence associated with smoking or positive smoking expectations.

Our findings also suggest that certain aspects of sensation tendencies, such as drug and alcohol sensation seeking, are more readily expressed through smoking than through physical activity, and that the latter insufficiently protects against the former. However, the highest levels of thrill and adventure seeking were found in physically active experimenters. Rodriguez *et al.* suggested that an adolescent's choice to engage in MVPA may be more a function of the immediate feeling roused by the activity, and less about an awareness of long-term benefits [8]. Thus, our results suggest among youth with high levels of thrill and adventure seeking, targeting interventions that promote physical activity as an alternative to smoking, could be an effective strategy. Of importance, among those with scores in the highest quartile of thrill and adventure seeking, 82% have experimented and 69% complete adequate MVPA (data not shown).

It is noteworthy that engaging in adequate MVPA does not appear to confer notable protection from experimentation against psychosocial factors associated with both behaviors including anxiety, low SSS, and poor body image. Our previous research suggests that among Mexican origin youth, a similar motivation might be in play for smoking, particularly as it relates to expression of coping with anxiety, poor body image, or low SSS [9-11]. Our findings in this study, however, suggest that the appeal of smoking might be stronger than that of physical activity for those with these less desirable psychosocial characteristics. Given that these same risk factors are associated with cur-

rent smoking and low levels of physical activity among adults our results underscore the possibility that adolescents with these characteristics may be particularly vulnerable for a lifetime of smoking and physical inactivity [34-39]. Additional research is warranted to determine whether it would be beneficial to tailor interventions to address both deleterious behaviors simultaneously.

Our study has methodological strengths. First, our sample came from a population-based cohort, representing an ethnically homogenous and predominantly low-income population of Mexican origin youth. This population is largely understudied and underserved. Furthermore, given the sensitive nature of some of the questions, it is also a strength that all data were collected using PDAs, which ensured that participants read and answered the questions without concern for their parents hearing or seeing their responses.

Our study has some limitations. For one, participants in our sample were all of Mexican origin. The homogeneity of our sample is a limitation in that it hinders the generalizability of our conclusions to other demographics, including other Hispanic youth from different countries of origin. Furthermore, smoking and alcohol-use were assessed *via* self-report and unverified using biological samples or other methods of cross-validation. Therefore, smoking and alcohol-use may be underreported. However, use of the PDA for data collection provided a secure non-invasive approach, away from parental eyes for reporting purposes. Evidence suggests, however, that the validity of self-reported data tends to increase when participants believe biological samples may be requested, which was the case in our study (saliva was collected for genetic analysis) [40]. Finally, while we examined social influence from family and friends regarding smoking behavior, we did not do so regarding physical activity. Given the important role of social influence on behavior and the importance of the family in the Mexican culture, it would be valuable to examine the role of social influence on physical activity in order to determine the relative influence of each.

Overall, our results have implications for smoking prevention and the promotion of physical activity among youth of Mexican origin. They highlight an

opportunity to address physical activity as an alternative to smoking among youth with high sensation-seeking tendencies and to engage those with less desirable psychosocial characteristics, such as low SSS, anxiety, and/or more body image concerns in health promotion activities to address both deleterious behaviors. By gaining a clearer understanding as to why Mexican origin youth do not engage in adequate MVPA and/or do smoke, future interventions can be designed to promote physical activity as capable of addressing some of those motivations. Based on our findings, such interventions would be particularly impactful if they targeted thrill and adventure seekers and addressed the sensation seeking-related motivations for smoking while promoting physical activity as an alternative. In addition, further research examining a broader range of risk factors that potentially relate to both behaviors, as well as appropriate messaging associating the benefits of MVPA with the appeal of smoking, is needed to further tailor such interventions.

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