



## Studying Adolescent Athletes for Evaluation of Mental Health and Substance Use in an Urban Setting

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### Abstract

This study aims to understand the association among sport participation, substance use and mental health of adolescent athletes within a diverse urban youth population. Data included a convenience sample of predominantly Black and Hispanic youth (85.7%) ages 14 to 18 years, who were Mount Sinai Adolescent Health Center (MSAHC) patients who presented for an annual physical exam or pre-participation exam (PPE) and were cleared for high school sport(s) participation. During the encounter, participants self-reported their use of tobacco, alcohol, and marijuana on a 6-point frequency scale, dichotomized to indicate use in the past 30 days. Anxiety and depression were assessed using two self-reported questions. Demographic data (e.g. ethnicity, gender, age) and whether participants had a current mental health provider were also extracted from the Electronic Medical Record (EMR). Results from multivariate logistic regression analyses showed adolescents with one year of sport participation had significantly lower odds of alcohol use in the past 30 days (OR=0.22, 95%CI= [0.12,0.41]) compared to individuals who did not participate in sport(s). Adolescents with two or more years of sport participation had significantly lower odds of alcohol (OR=0.46, 95%CI= [0.23,0.93]) and marijuana use (OR=0.10, 95%CI= [0.01,0.72]) in the past 30 days compared to individuals who did not participate in sport(s). Adolescents with one year of sport participation had lower odds of reported depression (OR=0.56, 95%CI= [0.33,0.94]) compared to individuals who did not participate in sport(s). Adolescents with two or more years of sport participation had significantly lower odds of reported depression (OR=0.35, 95%CI= [0.16,0.75]) and anxiety (OR=0.36, 95%CI= [0.15,0.86]) compared to individuals with no sport participation. These effects were found after adjusting for whether they were currently engaged with a mental health provider. Results of this study suggest that engagement in organized sport(s) may have protective effects against substance use, depression and anxiety. Additionally, the PPE could be used as an opportunity to promote engagement in extracurricular activities in addition to organized sports, to maximize the opportunity for adolescents to experience these benefits.

### Keywords

Adolescent, Drug Use, Mental Health, Depression, Sports

## Introduction

In the United States, mental health conditions and substance use continue to threaten the health of many adolescents, 49.5% of adolescents in the U.S. ages 13-18 years old had a mental health disorder [1] with depression impacting about one in eight adolescents and young adults each year [2]. Depression during adolescence is associated with significant morbidity including school failure, obesity and substance abuse [3]. If left untreated, serious consequences may follow with suicide being the second leading cause of death among adolescents with depressive symptomology [4]. Anxiety disorders also have been found to affect about 25% of adolescents between ages 13 and 18 years old [5]. Untreated mental health disorders during adolescence put them at higher risk for unhealthy outcomes, poor adjustment trajectories in adulthood, poor performance in school, missing out on important social experiences, and engaging in substance abuse [5]. Consequently, substance use is often linked to mental health disorders [6]. In 2017, 45.8% of high school students used marijuana and 40.8% of 12<sup>th</sup> graders drank alcohol [7].

Beyond the health benefits of physical activity, participation in an organized sport activity is argued to be linked with a wide range of positive social and psychological outcomes [8,9]. In contrast, some studies have supported a link between sport participation and negative outcomes for adolescents and young adults. For example, a study of adolescents ages 16 to 24 found an association between sport participation and higher rates of drinking alcohol [10]. Furthermore, college student-athletes report higher rates of “binge-drinking” in comparison to the general population of college students [11,12].

In addition to the association of sport participation and substance use noted in the literature, there have been studies showing a complex relationship between adolescent mental health and participation in an organized sport. It has been proposed that athletes may have increased anxiety as a result of the competitive nature of their sports, as well as their own concerns about their performance or the real or perceived performance expectations of their parents [13]. Athletes may exhibit increased anxiety and

depressive symptoms due to chronic stress whether they participate in an individual sport versus a team sport [14,15]. Alternatively, several studies have shown that sport(s) may protect against depression by boosting self-esteem, increasing social support, create healthier self-image and lower emotional distress [9,16,17].

Although substance use and mental health disorders have a complex interrelationship with sport participation, some argue that other factors may further modify the relationship such as racial/ethnic culture and community characteristics. In a study conducted by Taliaferro et al., a differential effect of sports was observed by race/ethnicity [18]. Some have observed multiple positive behaviors among white sport participants. Fewer positive behaviors, as well as negative behaviors, have been reported among African Americans, Hispanic and other non-white athletes [18]. In another study among African American high school females in rural and urban settings, those who played sports in rural areas reported higher levels of peer drug use for alcohol, marijuana and illicit drugs; whereas, in urban settings overall peer usage rates were lower, specifically for marijuana and other drugs, not alcohol [19].

There have been few studies looking at the utilization of mental health services among sport participants and its’ influence on mental health symptomology. Previous research indicates that young athletes use mental health services less often than adolescents and young adults who do not play a sport [20]. Among those adolescents who receive mental health services, it is unclear if their depressive and anxiety symptomology improvement can be attributed to sport participation, mental health engagement or both.

In summary, previous studies have presented variable results with respect to the impact of sports participation on mental health and substance use among urban youth. To further clarify this relationship, this study examined sport participation among diverse urban adolescent youth and the association of decreased substance use and mental health symptomology.

## Methods

### Sample:

This study used a convenience sample of 759 patients from the Mount Sinai Adolescent Health Center (MSAHC). The services at MSAHC provided are comprehensive, integrated, and adolescent and young adult-focused. The sample was selected using the following inclusion criteria: males and females aged 14 through 18 years old who completed an annual physical exam or pre-participation physical (PPE) from July 1, 2014 through December 31, 2017. The study was approved by the Institutional Review Board of Mount Sinai and used de-identified data.

### Measures:

#### Sport Participation:

Participation in sport was operationalized as having completed a PPE. The overarching goal of the medical visit is to maximize the health of athletes and their safe participation in sports. PPEs are required by New York State for school-age youth to engage in organized sports. A chart review of Electronic Medical Record (EMR) identified the subset of patients who completed PPEs as part of the annual physical, based on the providers' documentation of clearance to participate in sport(s). A mutually exclusive categorical variable was created to group the sample into no sport participation, sport participation for one year, and sport participation for two or more consecutive years. Since this was a retrospective study and used data from the EMR, sport participation was determined by completion of a physical to get clearance to play an organized sport and we were able to extract patients who were cleared to participate from documentation. Since high school athletes are not permitted to play organized sports without completing a PPE, this may be a more precise measure of organized sport participation than asking individuals if he/she play a sport, as patients may consider non-organized physical activity as sport participation.

#### HEADSSS:

During the annual physical, providers routinely screened adolescents using the Home, Education/Employment, Eating, Activities, Drugs and Alcohol, Sexuality, Anxiety, Suicide, Depression (HEADSSS) assessment, which is a highly regarded

psychosocial assessment tool. HEADSSS is primarily a confidential interview tool used during the medical visit to assess psychosocial risks in adolescents [21]. HEADSSS and demographic data were extracted from the EMR.

#### Substance Use:

The use of tobacco, marijuana, alcohol, and other illicit drugs were assessed from the HEADSSS assessment [21]. Adolescents rated their use of tobacco, marijuana, alcohol, and other illicit drugs on a 6-point scale ranging from never to daily use. Responses were dichotomized to indicate if substance use was current by categorizing if use was within the past 30 days (coded as 1=daily or used in the past 30 days, 0=never, ever, tried, or used in the last 12 months).

#### Mental Health:

Depression was assessed using responses from one question on the HEADSSS assessment: "Do you often feel down or depressed?" (1 = yes; 0 = no). Anxiety was measured by asking the participants "Have you ever felt nervous, anxious, on edge or worried?" (1 = yes; 0 = no). This is consistent with other studies that used self-reported items to measure depressive symptomology and anxious feelings [15].

#### Covariates:

A range of covariates were drawn from the EMR. Covariates included adolescent's gender (1=male, 2=female), age (in years), race/ethnicity (mutually exclusive categories: Black, Hispanic, White, Asian, Native American, and other), and whether they were born outside the U.S. (0=no, 1=yes). To adjust if patients have accessed mental health services, we included patient's report on whether they were currently receiving mental health services at the time of the medical visit or if they have in the past. Engagement in mental health service was dichotomized as currently engaging in mental health services at the MSAHC or elsewhere versus not currently seeing a mental health provider (i.e., also inclusive of those without any prior mental health services).

#### Statistical Analysis:

The distribution of adolescent demographic characteristics, substance use, reported depression and anxiety were presented as frequencies and percentages separately for youth who had no, one, and two or more PPEs. Chi-square tests were used to compare the three groups of adolescents in terms of demographics, substance use and mental health risk behaviors [22]. Next, a series of multivariate logistic regression models were conducted to examine the association between adolescent sport participation and substance use and mental health outcomes. For each outcome, we fit an unadjusted model in which sport participation, coded as dummy variables with the no sport participation group as the reference group, was entered as the predictor. We then fit an adjusted model in which demographic covariates (age, gender nativity, race/ethnicity, and mental health utilization) were added to the unadjusted model. A model for illicit drug use was not estimated because none of the patients with one or more years of sport participation reported

illicit drug use. All statistical analyses were conducted in SPSS 25.

## Results

In our sample of 759 participants, 158 (20.8%) patients had one record of sport clearance (i.e., year of participation), 106 (14%) patients had two or more records of sport clearance (i.e., two or more years of sport participation), and 495 participants (65.2%) had no record of sport clearance (**Table-1**). The majority of study participants were females (60.7%), born in the United States (85.7%), and were Black (42.4%) or Hispanic (43.3%). A total of 4.1% of participants reported tobacco use, 11.2% reported marijuana use, 26.5% reported alcohol use, and 0.7% reported illicit drug use in the past 30 days. The rates of tobacco, marijuana, and alcohol use were highest among participants with no sport participation (5.5%, 15.6%, and 35.8%, respectively).

Characteristics	No sport Participation (n = 495)	One year of sport participation (n = 158)	Two or more years of sport participation (n = 106)	Total (n=759)	p-value
	n(%)	n(%)	n(%)	n(%)	
<b>Gender</b>					0.001
Female	336 (67.9%)	86 (54.4%)	39 (36.8%)	461 (60.7%)	
Male	159 (32.1%)	72 (45.6%)	67 (63.2%)	298 (39.3%)	
<b>Age</b>	16.0 (1.1)	15.4 (1.0)	15.1 (0.8)	15.7 (1.1%)	0.001
<b>Born in the United States</b>					0.411
No	60 (13.3%)	20 (14.7%)	15 (19.0%)	95 (14.3%)	
Yes	390 (86.7%)	116 (85.3%)	64 (81.0%)	570 (85.7)	
<b>Race/ethnicity</b>					0.083
Black	210 (42.4%)	68 (43.0%)	42 (39.6%)	320 (42.4%)	
Hispanic	221 (44.6%)	64 (40.5%)	43 (40.6%)	328 (43.3%)	
White	17 (3.4%)	5 (3.2%)	4 (3.8%)	26 (3.4%)	
Asian	10 (2.0%)	7 (4.4%)	4 (3.8%)	21 (2.8%)	
Other	37 (7.5%)	14 (8.9%)	13 (11.8%)	64 (8.4%)	
<b>Tobacco use in past 30 days</b>					0.019

No	462 (96.5%)	153 (97.5%)	100 (100.0%)	721 (95.9%)	
Yes	27 (5.5%)	4 (2.5%)	0 (0.0%)	31 (4.1%)	
<b>Marijuana use in past 30 days</b>					<i>0.001</i>
No	365 (84.4%)	145 (93.5%)	104 (98.1%)	644 (88.3%)	
Yes	73 (15.6%)	10 (6.5%)	2 (1.9%)	85 (11.2%)	
<b>Alcohol use in past 30 days</b>					<i>0.001</i>
No	318 (64.2%)	145 (91.7%)	95 (89.6%)	558 (73.5%)	
Yes	177 (35.8%)	13 (8.2%)	11 (10.4%)	201 (26.5%)	
<b>Other illicit drug in past 30 days</b>					<i>0.261</i>
No	489 (99.0%)	158 (100.0%)	106 (100.0%)	753 (99.3%)	
Yes	5 (1.0%)	0 (0.0%)	0 (0.0%)	5 (0.7%)	
<b>Anxiety</b>					<i>0.001</i>
No	315 (64.0%)	129 (81.6%)	90 (87.4%)	534 (70.9%)	
Yes	177 (36.0%)	29 (18.4%)	13 (12.6%)	219 (29.2%)	
<b>Depression</b>					<i>0.001</i>
No	280 (56.6%)	127 (80.4%)	94 (88.7%)	501 (66.0%)	
Yes	215 (43.4%)	31 (19.6%)	12 (11.3%)	258 (34.0%)	
<b>Mental health provider</b>					<i>0.001</i>
No prior mental health visit	176 (49.2%)	70 (68.6%)	63 (88.7%)	309 (58.2%)	
Currently seen at Center	39 (10.9%)	4 (3.9%)	1 (1.4%)	44 (5.8%)	
Being seen elsewhere	33 (9.2%)	7 (6.9%)	2 (2.8%)	42 (5.5%)	
Used to see mental health provider	110 (30.7%)	21 (20.6%)	5 (7.0%)	136 (30.3%)	
<sup>1</sup> p-values were based on chi-square test of independence for categorical variables or analysis of variance for continuous variables					

We observed statistically significant differences among the three groups (i.e., no sport participation, one year of sport participation, two or more years of sport participation) gender ( $p < 0.001$ ), age ( $p < 0.001$ ), tobacco use ( $p = 0.051$ ), marijuana use ( $p < 0.001$ ), alcohol use ( $p < 0.001$ ), anxiety ( $p < 0.001$ ), depression ( $p < 0.001$ ) and engagement in mental health services ( $p < 0.001$ ; **Table-1**).

As shown in **Table-2**, results from multivariate logistic regression analyses showed that adolescents with one year and two or more years had lower odds of using marijuana (OR= 0.37,  $p < 0.01$ ; OR= 0.10,  $P <$

0.01) and alcohol (OR= 0.16,  $p < 0.001$ ; OR= 0.21,  $p < 0.001$ ), respectively. After adjusting for demographic covariates and mental health utilization, adolescents with one year of sport participation had significantly lower odds of using alcohol in the past 30 days compared to individuals who did not participate in sport(s) (aOR= 0.22,  $P < 0.001$ ). Adolescents with two or more years of sport participation had significantly lower odds of using alcohol (aOR= 0.46,  $p < 0.05$ ) as well as marijuana (aOR=0.10,  $p < 0.05$ ) in the past 30 days compared to individuals who did not participate in sport(s). There were no significant differences in tobacco use.

	Tobacco use		Marijuana use		Alcohol use	
	OR	aOR	OR	aOR	OR	aOR
<b>Sport participation (ref. = no)</b>						
One year	0.45 (0.15, 1.30)	0.58 (0.19, 1.74)	0.37 (0.19, 0.74)**	0.50 (0.25, 1.03)	0.16 (0.09, 0.29)***	0.22 (0.12, 0.41)***
Two or more years	-	-	0.10 (0.03, 0.43)**	0.10 (0.01, 0.72)*	0.21 (0.11, 0.40)***	0.46 (0.23, 0.93)*
<b>Covariates</b>						
Male		1.22 (0.54, 2.73)		1.14 (0.67, 1.91)		0.74 (0.50, 1.09)
Black vs Other		4.54 (0.59, 35.12)		1.56 (0.65, 3.74)		0.83 (0.47, 1.47)
Hispanic vs Other		2.92 (0.37, 23.37)		1.34 (0.56, 3.23)		1.12 (0.63, 1.97)
Born outside the U.S.		-		0.27 (0.10, 0.78) **		0.62 (0.36, 1.09)
Age in years		1.35 (0.95, 1.92)		1.47 (1.17, 1.85) ***		1.69 (1.43, 2.01)***
<b>Note:</b> OR = odds ratio. aOR adjusted for age, gender, nativity, and race/ethnicity. * p < .05, ** p < .01, *** p < .001. In the tobacco use model, two or more years was not estimated because cell size equals zero						

	Anxiety		Depression	
	OR	aOR	OR	aOR
<b>Sport participation (ref. = no)</b>				
One year	0.40 (0.26, 0.62)***	0.67 (0.39, 1.17)	0.32 (0.21, 0.49)***	0.56 (0.33, 0.94)*
Two or more years	0.26 (0.14, 0.47)***	0.36 (0.15, 0.86)*	0.17 (0.09, 0.31)***	0.35 (0.16, 0.75)**
<b>Covariates</b>				
Male		0.47 (0.29, 0.75)**		0.38 (0.24, 0.60)***
Black vs Other		0.68 (0.33, 1.38)		0.98 (0.48, 2.01)
Hispanic vs Other		0.68 (0.34, 1.37)		1.06 (0.52, 2.14))
Born Outside the U.S.		0.83 (0.45, 1.50)		0.81 (0.46, 1.45)
Age in years		1.19 (0.99, 1.43)		1.02 (0.86, 1.23)
Current Mental Health Provider		3.56 (2.14, 5.91)***		4.72 (2.75, 8.08)***
<b>Note:</b> OR = odds ratio. aOR adjusted for age, gender, nativity, race/ethnicity, and current mental health provider. *p < .05, **p < .01, ***p < .001				

	Anxiety			Depression		
	Model-1	Model-2	Model-3	Model-1	Model-2	Model-3
<b>Sport participation (ref. = no)</b>						
One year	0.73 (0.40, 1.31)	0.68 (0.39, 1.19)	0.71 (0.38, 1.34)	0.62 (0.36, 1.08)	0.57 (0.34, 0.97)*	0.45 (0.24, 0.84)*
Two or more years	0.35 (0.14, 0.87)*	0.27 (0.08, 0.87)*	0.45 (0.16, 1.28)	0.37 (1.67, 0.80)*	0.44 (0.20, 1.01)	0.36 (0.14, 0.93)*
<b>Interactions</b>						
One year x Mental health services	0.61 (0.14, 2.70)	-	-	0.46 (0.10, 2.03)	-	-
Two or more years x Mental health services	1.77 (0.09, 34.48)	-	-	0.63 (0.03, 11.97)	-	-
One year x Age	-	1.67 (0.97, 2.88)	-	-	1.65 (0.98, 2.79)	-
Two or more years x Age	-	0.67 (0.21, 2.10)	-	-	1.96 (0.80, 4.76)	-
One year x Male	-	-	0.80 (0.23, 2.78)	-	-	2.16 (0.69, 6.72)
Two or more years x Male	-	-	0.53 (0.08, 3.31)	-	-	0.93 (0.19, 4.58)
<b>Covariates</b>						
Male	0.46 (0.29, 0.75)**	0.44 (0.27, 0.72)***	0.51 (0.29, 0.90)*	0.37 (0.23, 0.59)***	0.35 (0.22, 0.56)***	0.32 (0.18, 0.57)***
Black vs Other	0.68 (0.33, 1.39)	0.67 (0.33, 1.38)	0.67 (0.33, 1.36)	1.00 (0.49, 2.04)	1.00 (0.49, 2.05)	0.99 (0.48, 2.02)
Hispanic vs Other	0.68 (0.34, 1.38)	0.67 (0.33, 1.36)	0.67 (0.33, 1.36)	1.06 (0.52, 2.16))	1.05 (0.52, 2.13)	1.05 (0.52, 2.14)
Born outside the U.S.	0.83 (0.45, 1.50)	0.84 (0.46, 1.53)	0.84 (0.46, 1.52)	0.81 (0.45, 1.44)	0.83 (0.46, 1.50)	0.82 (0.46, 1.47)
Age in years	1.19 (0.99, 1.43)	1.13 (0.92, 1.38)	1.20 (1.00, 1.44)	1.02 (0.86, 1.23)	0.93 (0.76, 1.13)	1.01 (0.85, 1.21)
Mental Health Services	3.75 (2.14, 6.56)***	3.60 (2.16, 5.99)***	3.48 (2.09, 5.80)***	5.43 (2.94, 10.01)***	4.84 (2.81, 8.33)***	4.89 (2.83, 8.48)***
<b>Note:</b> Models 1-3 tested the moderating effects of current mental health services, age, and gender sequentially on the association between sport participation and anxiety and depression. * p < .05, ** p < .01, *** p < .001						

**Table-3** presents findings on the association between sport participation and mental health outcomes. The unadjusted model showed that adolescents with one year and two or more years of sport participation had significantly lower odds of reporting anxiety (OR= 0.40,  $p < 0.001$ ; OR= 0.26,  $P < 0.001$ ) and depression (OR= 0.32,  $p < 0.001$ ; OR= 0.17,  $p < 0.001$ ). After adjusting for demographic covariates and engagement with a mental health provider, adolescents with one year of sport participation had lower odds of reporting depression (aOR= 0.56,  $p < 0.05$ ) compared to individuals who did not participate in sport(s). Adolescents with two or more years of sport participation had significantly lower odds of reporting depression (aOR= 0.35,  $p < 0.01$ ) and anxiety (aOR=0.36,  $p < 0.05$ ) compared to individuals with no sport participation.

We conducted additional analysis to examine whether the effect of sport participation on anxiety and depression was moderated by current mental health service engagement, age, and gender. As shown in **Table-4**, results showed no significant moderating effect of mental health service engagement, age, and gender on the association between sport participation and anxiety and depression.

## Discussion

### *Sport Participation and Mental Health:*

Although there is growing literature studying the effect of sport participation on adolescents, few studies have examined the association between sport participation and psychosocial outcomes in urban minority youth. Similar to prior studies that have documented associations between sport participation and positive behaviors [9,16,23,24], current findings further support psychosocial benefits of sport participation for young people. For instance, sport participation is associated with lower odds of reporting depressive symptoms, anxiety and substance use. Similar findings have been reported in the literature [9,16]. Many factors related to sport participation including increased self-esteem [19], increased social support [9], healthier self-image and lower emotional distress [17] can contribute to lower rates of depression among adolescent athletes. Additionally, sport participation provides adolescents

with opportunities to bond with their peers, feel connected to their school and interact with their peers and coaches [25]. In a prior study, it had been suggested that the competitive nature and high intensity of certain sports trigger neuroprotective effects that counteract or prevent poor mental health [26]. According to Gorham et al., pre-adolescent males involved in team sports were less likely to present with depressive symptomology which was positively correlated with hippocampal volume, suggesting the impact of sport involvement on the neural mechanism of the developing brain [27].

Mixed findings have been reported in the link between sport participation and anxiety. Findings from the current study suggest that the lower odds for anxiety is linked to engagement in sport(s) for two or more years. The mixed results could be attributed to many factors such as the level of competition, perceived sport competence, and/or specific sport in which athletes participate [13]. Sport participation had been associated with a high occurrence of psychological difficulties such as pressure, stress, burnout and immoral behaviour [23]. It is likely that at a more competitive level, there are greater performance expectations which may contribute to anxiety. An additional stressor is placed on high school athletes who are competing for college acceptance or scholarship money related to collegiate level sport participation. Additional explanations that may be protective with respect to anxiety include quality of life and adequacy of coaching. Ledochowski and colleagues found that youth who reported high quality of life and having a coach that is knowledgeable about the sport, organized, and teaches techniques and strategies of the sport experienced less anxiety [28]. Adolescents, who engage in a sport for a longer period of time, two or more years, may be less likely to manifest anxiety as a result of experiencing the positive impact of sports over a longer period of time. Studies have suggested that benefits of sport participation are likely to be synergistic in that those who participate in sport(s) experience benefits to their mental health which in turn promotes continued participation that will further enhance mental health [29].

### *Sport Participation and Substance Use:*



Research has yielded inconsistent findings regarding the relationship of alcohol use among high school students involved in organized sport(s). Some studies report decreased use of alcohol among youth who participated in sport(s) [30,31]. Although findings revealed that sport participants were less likely to use alcohol if they played sport for one or more years, studies have shown an increased use of alcohol in high school aged students involved in team sports [32,33], specifically binge drinking [11,34]. According to the NCAA, binge-drinking or heavy episodic drinking is more commonly seen in student athletes compared to other students on campus [11]. In addition, increased drinking was found to be associated with sport participation according to Eccles and colleagues [10]. This may be secondary to heavy drinking and advertising of alcohol at the time of sporting events, ultimately normalizing the perception of alcohol use among young athletes [12,35]. A strong predictor of binge drinking in college among athletes was having binged in high school [34]. Therefore, if high school sport participation were protective against alcohol consumption this could lead to less binge drinking among athletes in college.

It is well documented in the literature that adolescents who regularly engage in physical activity, like adolescents who participate in competitive sports [36], typically abstain from traditional cigarette smoking [37]. This may be because cigarette smoking shows immediate physical ramifications on athletic performance, and when students can understand that a behavior will interfere with their performance, they can forgo it [34,38]. There were no significant differences found with tobacco use and sport participation in the current findings. Past research indicates possible explanations for why nonsignificant associations have been found. Physical activity and smoking may both serve as weight-control strategies, people who are generally health conscious, but nevertheless smoke cigarettes, may use physical activity as a harm reduction strategy [39].

#### *Sport Participation and Mental Health Utilization:*

A previous study showed that sport participants were less likely to have a history of seeing a mental health provider in the past compared to their

counterparts [20]. We examined the link between utilization of mental health services and sport participation among youth. Findings in this study revealed that a larger percent of non-sport participants were engaged in ongoing mental health services, at MSAHC or with outside providers (20.1%), compared to sport participants (one sport 10.8% and two or more sports 6.3%). The aforementioned results show there is no moderating effect of mental health service engagement on the association between sport participation and anxiety and depression symptomology, meaning that of the adolescents who engaged in mental health services, the reported lower odds of depressive and anxiety symptomology were independent of mental health service utilization.

#### *Sport Participation Association with Race/Ethnicity and Gender:*

The relationship of race/ethnicity and the modifying effects of sport participation on health risk behaviors were demonstrated to have positive effects in white students in several studies. They were less likely to use alcohol and marijuana, contemplate or attempt suicide compared to non-athletes [18]. Whereas, African Americans and Hispanics showed fewer positive behaviors and some negative behaviors like binge drinking [18]. Our study, which predominantly includes African American and Hispanic youth (85.7%), challenges the previous study. Our study reports less use of alcohol and marijuana among sport participants compared to non-participants. Furthermore, sport participants were less likely to use alcohol the longer participants were engaged in sport(s).

An observation of this study is that within a clinic which provides care to mostly female patients, the majority of the participants were male. This highlights the opportunity afforded by a PPE visit to engage male patients in identifying a medical home and primary care provider. This will hopefully promote comprehensive, efficient longitudinal care.

#### **Limitations**

There are several limitations present in this study. Sport participation was inferred from an annual physical or PPE where patients were authorized

sport(s) clearance. Adolescents, who were cleared to participate, may not have followed through with their intention to participate which means the sport participants could potentially have represented adolescents who did not participate in a sport. On the contrary, adolescents marked as “no sport participation” may have participated in organized sport(s), but did not have their PPE completed at MSAHC. Another limitation is that those who do not use substances and who have fewer mental health conditions choose to participate in sport(s), thus the findings could be related to who select into playing sport(s). Additionally, our study did not look at the impact of different sports or if participants engaged in an individual versus team sport. Moreover, the level of competition, whether it was a high school sport, local program, club sport or travel sport could be relevant.

Some of these limitations could be avoided if patients were followed over the course of their sport involvement, which in turn, would demonstrate if they truly participated in the sport in which they presented for clearance to play. Additionally, obtaining a more thorough history of the details of their sport participation, such as the type of sport and the level of competition, would further clarify if the association of substance use and mental health symptomology are linked to these parameters.

## Conclusion

Our findings further support that urban minority youth who engage in sport(s) have decreased substance use, depression and anxiety compared to their non-participant peers. Clinicians caring for youth should be aware of the benefits of promoting sport participation in this population and include efforts to target prevention against mental health conditions and substance use. This can be enhanced by decreasing barriers for sport participation; and therefore, increasing access for youth. Furthermore, clearance to play sport(s) should be expanded to include various extracurricular activities, in addition to organized sport(s), allowing adolescents to capitalize on the benefits of sport participation. This study reinforces the advantage of assessing risk through screening questions at health encounters and utilizing annual physicals for sport clearance to facilitate

engagement of patients in their medical care. Additionally, it gives clinicians the opportunity to counsel and promote ongoing support for sport participation at these visits. As well as, highlights the potential positive impact of school-based interventions and programming surrounding increased opportunity for after school activities. More research is needed to identify what aspects of playing a sport is linked to mental health and substance use.

## Conflict of Interests

All authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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