J Youth Adolescence (2018) 47:818–828
DOI 10.1007/s10964-017-0687-3

EMPIRICAL RESEARCH

The Moderating Role of Spirituality in the Association between Stress and Substance Use among Adolescents: Differences by Gender

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Received: 28 February 2017 / Accepted: 2 May 2017 / Published online: 10 May 2017

Abstract Adolescents are exposed to various stressors that may increase the risk for substance use. Due to the detrimental, and potentially long-lasting, effects related to substance use, it is necessary to explore more optimal coping strategies. This study explored the association between substance use and stress among male and female high school students in relation to spirituality as a moderator. To examine these relationships, the study used cross-sectional data collected from 27,874 high school students (Male = 50.7%, Female = 49.3%) across 58 high schools in Maryland that included an ethnically diverse sample (49% Caucasian, 30% African American) with an average age of 16 years old. Bivariate results showed differences in substance use, stress, and spirituality between male and female students. Higher rates of substance use were generally found among male students compared to female students; rates tended to be higher among female students for stress and spirituality compared to their male counterparts. Multilevel analyses indicated a positive association between stress and substance use among male and female students after adjusting for demographic and school-level factors. Both male and female students who reported turning to spiritual beliefs when experiencing problems were less likely to use substances. However, the interaction between stress and spirituality was significant for males only. These findings suggest that stress may increase the propensity for substance use and that spirituality might be a viable coping mechanism useful for helping high school students adapt to stressful circumstances and situations.

Keywords Adolescents · Substance use · Stress · Spirituality · Gender

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Introduction

Many consider adolescence to be a tumultuous time in life, marked by struggles for independence, emotional instability, highly influential peer relationships, and vulnerability to experimental behaviors. Of particular concern is adolescents' engagement in risky behavior, such as the use of alcohol, tobacco, and other substances. National data indicate that approximately 23.5% of high school sophomores used alcohol in the past month, 3.2% smoked cigarettes, and 16.6% used marijuana (Substance Abuse and Mental Health Services Administration [SAMHSA] 2014). The rates increased among high school seniors, with 37.4% using alcohol in the past month, 6.7% smoking cigarettes, and 21.2% using marijuana.

Much of the literature suggests that increased stress levels are one of the factors that push adolescents to engage in substance use (Charles et al. 2015). Adolescents experience developmental changes that can increase stress, and some may rely on negative coping strategies, such as substance abuse or other risky behaviors (Williams and McGillicuddy-De Lisi 1999). This is particularly concerning because of the association between substance use and various immediate and long-term consequences, such as lower levels of academic achievement (Hill and Mrug 2015), risky sexual behavior (Rhode et al. 2007), and aggressive behavior (Brook et al. 2013). Additionally, substance use increases the risk for developing substance dependencies and criminal involvement into adulthood (Volkow et al. 2014), lessening opportunities for long-term employment prospects and overall quality of life (Lee et al. 2015).

Given the potential for these negative consequences and outcomes from substance use, it is critical to understand potential protective mechanisms that are effective in buffering the effects of stress for adolescents. In order to expand on previous research, the present study examined the role of spirituality in the association between stress and substance use among adolescents, with a focus on potential differences by gender.

Adolescent Stress and Vulnerability to Substance Use

Stress is defined as the perception and reaction to stimuli seen as threatening or harmful (Cohen et al. 1995). Adolescents undergo extensive biological, emotional, and social changes, some of which can cause individuals to experience feelings of stress. Additionally, some may be exposed to chronically negative environmental conditions (e.g., crime and violence) that can be quite overwhelming (Kitsantas et al. 2004). Although stress is a common and a natural part of life for individuals of all ages, youth are at exceptional risk because pressures and stress may increase quickly before coping mechanisms and consequence thinking are fully developed (Williams and McGillicuddy-De Lisi 1999).

The stress-vulnerability and coping behavioral models illustrate the connection between stress and negative behavioral responses. Specifically, the stress-vulnerability model posits that stress can strain individuals' adaptation capability and increase the chance of a poor behavioral response (Brown et al. 1995). The cognitive behavioral model further articulates that those with fewer, ineffective, or detrimental coping methods, and who experience stressful environments, are at the highest risk for negative responses (Marlatt and Gordon 1985).

Taken together, these models suggest that adolescents who experience higher levels of stress may engage in negative behaviors, such as substance use. These theoretical frameworks are supported by empirical research. For example, Charles et al. (2017) found that younger adolescents who experienced stressful life events or extreme stressors showed significantly higher rates of substance use by the age of 15. Research also shows that adolescents who experience less positive relationships with family members experience higher levels of stress and earlier onset of substance use (Charles et al. 2015). Furthermore, Coley et al. (2017) found that experiencing stressful events and witnessing others use substances was more strongly associated with adolescent substance use than the presence of genetic indicators frequently linked to substance use and dependencies.

These theoretical frameworks, together with the extant empirical literature, suggest that adolescents may turn to substance use when feeling stressed, perhaps because they have a lack positive, stress-relieving methods. Thus, it is critical to examine coping strategies that can effectively reduce stress and lessen the risk for engaging in harmful behavioral responses (Anderson et al. 2006). One such potential moderator is spirituality, as there is compelling evidence that this may be an effective buffer against substance use for adolescents.

Spirituality as a Moderator and Coping Mechanism

Religion and spirituality are commonly considered a source of support and protection against adversity. However, it is important to note that there is extensive debate regarding definitions of religiosity and spirituality; there is also some disagreement as to their relative meanings. The constructs have been referred to as "distinguishable yet overlapping" (Miller and Thoresen 2003). Religiosity has been defined as "an organized system of beliefs, practices, rituals, and symbols," whereas spirituality is characterized as "one's transcendent relationship to some form of higher power" (Thoresen 1998, p. 415). Many also suggest that spirituality is connected to the broader idea of providing meaning for life and greater self-awareness (Horton and Luna 2016). The constructs examined in the current study are not a comprehensive assessment of either religiosity or spirituality. Rather, we focused on faith and spiritual beliefs, as it is more closely aligned with spirituality.

Scholars have suggested that spirituality provides individuals with an array of benefits including elevated mood and optimal stress-management (Horton et al. 2016). Spirituality promotes positive coping strategies, such as prayer (Pargament et al. 2004), mediation, and mindfulness that allows individuals to reflect and reframe their attitudes and emotional responses to negative life experiences (Horton and Luna 2016). The common explanation for this centers on the idea that faith and heightened self-reflection

empowers individuals to persevere through tough situations, acting as a safeguard against stress. Additionally, spirituality can connect individuals through congregations or volunteer events, opening up support networks, and may motivate individuals to seek out more positive outlets while condemning other behaviors (Pargament et al. 2004).

Existing research suggests that spirituality is a protective factor against stress. For example, Krok (2015) examined religiosity and spirituality among young adults and found that both constructs strongly correlated with positive, task-oriented coping strategies. However, this study also indicated that spirituality showed an even stronger association compared to religiosity. It is possible that the broadness of spirituality in terms of mediation and mindfulness may lead young adults to reflect on difficult experiences, reframe their outlook in a more positive manner, and rely upon more optimal behavioral outlets (Krok 2015). Similar findings were observed among high school students in the Midwest. Students who indicated higher spirituality engaged in less risky behaviors, including lower alcohol and other drug use (Cotton et al. 2005). Additionally, they also showed fewer depressive symptoms and higher levels of well-being.

Scholars have also tested the efficacy of spirituality as a protective factor for adolescents who are exposed to higher risk environments. One study compared cigarette, alcohol, and marijuana use among adolescents attending alternative schools, considered to be a higher risk population, and students in magnet schools, a lower risk population (Ritt-Olson et al. 2004). Although, the alternative school students demonstrated higher levels of substance use overall, students from both groups who indicated spiritual beliefs demonstrated significantly less substance use compared to their non-spiritual peers. Additionally, the higher risk group showed the strongest association between spirituality and less use in all three substance categories (Ritt-Olson et al. 2004).

Gender and Spirituality

There is also evidence to suggest that spirituality is often stronger among females compared to males. Indeed, adolescent females more often describe their spirituality as an important part of their lives and more frequently participate in religious services and activities compared to males (Kovacs et al. 2011). Young women are also more likely to credit their spiritual upbringing as important to their moral development and rely on their beliefs in making daily decisions in comparison to their male counterparts (Porche et al. 2015). Although many scholars have examined the difference in religiosity among men and women, fewer studies have specifically examined the differences of spirituality for men and women as it relates to stress and substance use. A study of college engineering students found that both men and women showed lower levels of stress as they reported higher spirituality (Yadav et al. 2017). However, the relationship was slightly stronger for females, and, overall, female students reported spiritual ties more frequently than males.

Although an extensive literature base shows that females tend to report greater religiosity, some evidence suggests that males often derive greater health benefits from religious support (Ellison and Henderson 2011). This discrepancy demonstrates that it is important to consider if there are similar differences for spirituality by gender as it appears to exist for religiosity. Thus, an aim of the current study was to examine the role of gender and spirituality in the association between stress and substance use among adolescents.

School Context and Stress

There is extensive research demonstrating that school factors (i.e., school safety, aggressive behaviors) can be a source of stress for students and teachers. Yet there is also evidence suggesting that school factors can provide buffering effects against negative coping strategies among adolescents. For instance, in schools where students experienced positive relationships with peers and general feelings of belongingness, students were found to be less likely to engage in substance use (McNeely and Falci 2004). Students who perceived more support from teachers and felt their teacher cared about their wellbeing were also less likely to engage in cigarette, alcohol, and other drug use (McNeely and Falci 2004).

Additionally, student perception of school safety is associated with substance use. Schools where students perceived a higher chance of being harmed, showed increased levels of substance use (Kitsantas et al. 2004). Furthermore, previous research has reported negative associations between school religiosity and students' alcohol use. Specifically, Debnam et al. (2016) found that middle school adolescents, in a spiritual school environment, who felt their faith was important reported lower levels of substance use. Given that students spend a significant amount of time in the school environment, it is important for researchers to consider how these contextual factors potentially influence stress and substance use behaviors among students.

Current Study

The purpose of this study was to investigate the role of spirituality in the association between stress and substance use. Limited prior research examines the specific contribution of spirituality as a moderating variable in the association between stress and substance use for adolescents. It is

hypothesized that the moderating role of spirituality in the association between stress and substance use will provide greater evidence for its use as a protective factor among adolescents. Particular attention is paid to exploring the associations by gender in order to understand if differences in the efficacy of spirituality on stress and substance use exists, as it appears to with religiosity. Previous *religiosity* research shows inconsistent health effects by gender, but less is known about spirituality by gender. It was hypothesized that spirituality will act as a moderator for females only, given research supporting increased levels of spirituality for females. Finally, given the existing literature detailing the role of a spiritual school environment and school support in adolescent substance use, we also examined the additive role of school contextual factors and substance use. We hypothesized that school connectedness, student support, and safety would serve as a protective against substance use among youth.

Methods

Participants

Data for the current study came from the Maryland Safe and Supportive Schools (MDS3) Initiative, which is a statewide initiative focused on measuring and improving school climate (i.e., safety, engagement, and environment). Anonymous self-report data were collected by MDS3 in spring 2013 via an online survey completed by students across the participating schools (Bradshaw et al. 2014). In total, 27,874 high school students across 58 schools were included in the sample. The sample was 49% Caucasian, 30.2% African American, 4.9% Hispanic/Latino, and 4.5% Asian/Pacific Islander. The average age of the sample was 15.9 (SD = 1.4) years old. Additional demographic information for the analytic sample is provided in Table 1.

Procedures

The Maryland State Department of Education approached local school districts for participation in the initiative. Upon expressing interest in MDS3, meetings were conducted to obtain school-level and principal commitment to the project. Schools' participation in the MDS3 project was voluntary. Once schools agreed to participate, letters were sent home to parents providing information about the survey and the larger initiative. An anonymous online student survey was administered using a waiver of parental consent process and student assent process; all student participation was voluntary. The survey was administered online in 25 language arts classrooms, including approximately seven 9th grade classrooms and six 10th, 11th, and 12th grade

Table 1 Descriptive characteristics of high school students

	Males n (%)	Females n (%)	*p*
Caucasian	6371 (52.9)	6371 (52.3)	.424
Mean age (SD)	16.0 (1.3)	15.8 (1.2)	<.001
Grade			
9th	3430 (28.5)	3540 (29.1)	.011
10th	2968 (24.6)	3157 (25.9)	
11th	2924 (24.3)	2885 (23.7)	
12th	2730 (22.7)	2588 (21.3)	
Past month substance use			
Marijuana	2791 (23.2)	2255 (18.5)	<.001
Prescription drugs	1267 (10.5)	882 (7.3)	<.001
Other substances to get high (K2, spice, bath salts)	979 (8.1)	496 (4.1)	<.001
Stress (in the past month)			
Have trouble falling asleep			
Never	4056 (33.7)	2965 (24.4)	<.001
Sometimes	4252 (35.3)	4530 (37.2)	
Often	2162 (17.9)	2651 (21.8)	
Almost always	1575 (13.1)	2016 (16.6)	
Feel you did not get enough sleep or rest			
Never	1895 (15.7)	1040 (8.6)	<.001
Sometimes	3528 (29.3)	2898 (23.8)	
Often	3372 (28.0)	3569 (29.4)	
Almost always	3239 (26.9)	4649 (38.2)	
Feel stressed			
Never	3145 (26.1)	1290 (10.6)	<.001
Sometimes	4170 (34.7)	3649 (30.0)	
Often	2734 (22.7)	3580 (29.4)	
Almost always	1981 (16.5)	3638 (29.9)	
Difficulties were piling up so high that you could not overcome them			
Never	4739 (39.4)	3225 (26.5)	<.001
Sometimes	3635 (30.2)	3893 (32.0)	
Often	2136 (17.8)	2674 (22.0)	
Almost always	1522 (12.6)	2371 (19.5)	
Spirituality			
How important (if at all) is your faith to you?			
Not important at all	2211 (18.4)	1534 (12.6)	<.001
Somewhat not important	2671 (22.2)	2353 (19.3)	
Somewhat important	4116 (34.2)	4586 (37.7)	
Very important	3038 (25.2)	3694 (30.4)	
I turn to my spiritual beliefs for when I have personal problems or problems at school			
Strongly agree	1754 (14.6)	1967 (16.2)	<.001
Agree	3906 (32.4)	4232 (34.8)	

Table 1 continued

	Males n (%)	Females n (%)	*p*
Disagree	3242 (26.9)	3321 (27.3)	
Strongly disagree	3151 (26.1)	2651 (21.8)	
School-level			
% Minority	46.8 (25.1)		
% Free and reduced priced meals	37.5 (17.8)		

classrooms. School staff administered the survey during class time following a written protocol developed by the university-based research team. No incentives to participate were provided to students. Analyses for these data was approved by the authors' Institutional Review Board.

Measures

Substance use

This investigation focused on past month use of marijuana, non-medical use of prescription drugs, and other substances used to get high (e.g., K2, spice, bath salts). Questions assessing substance use were adapted from the Youth Risk Behavior Surveillance (YRBS) System (Centers for Disease Control and Prevention [CDC] 2014). The substance use questions assessed the number of days that participants used prescription drugs for non-medical reasons, marijuana, and other substances to get high during the past 30 days (i.e., 0 days, 1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days, and all 30 days). The responses were dichotomized to indicate past month use of each of the substances.

Stress

Four questions were used to assess stress over the past month (CDC 2014). Participants were asked, "During the past 30 days, how often did you": (1) have trouble falling asleep; (2) feel you did not get enough sleep or rest; (3) feel stressed; and, (4) felt that difficulties were piling up so high that you could not overcome them. Responses were recorded using a Likert scale (e.g., almost always, often, sometimes, never) [α] = .80).

Spirituality

Based on items from the National Longitudinal Study of Adolescent to Adult Health, two questions were used to assess students' spirituality/faith (Harris et al. 2009): (1) "How important (if at all) is your faith to you?"; and (2) "I turn to my spiritual beliefs when I have personal problems or problems at school?" *Importance of faith* was assessed using a 4-point Likert scale with responses ranging from, not important at all, to, very important. The variable was later dichotomized for analysis due to uneven distribution (1 = important vs. 0 = not important). Participants' response to *turning to their spiritual beliefs* was measured on a 4-point Likert scale ranging from strongly agree to strongly disagree. This variable was also dichotomized and reverse coded (0 = disagree vs. 1 = agree).

Covariates

The individual-level covariates included age, gender, race/ethnicity, and report card grades. School-level variables included three scales from the MDS3 school climate survey (Bradshaw et al. 2014) aggregated to the school-level: (1) *perceived safety* (e.g., I feel safe at this school; students carry guns or knives; $\alpha = .68$); (2) *school support* (e.g., teachers at my school help students with their problems; there is someone at the school who I can talk to about personal problems; $\alpha = .78$); and (3) *student connectedness* (e.g., I feel like I belong; students trust one another; $\alpha = .87$). As described above, the importance of the students' faith (i.e., How important [if at all] is your faith to you?) was averaged for each school and included as a school-level variable. The percentage of students receiving free and reduced priced meals (proxy for poverty), and the percentage of minority students were also included as school-level covariates.

Data Analysis

Bivariate (chi-square, Pearson correlations) analytic procedures were used to address differences in student- and school- level characteristics by gender. Multilevel models were further used to assess the relationship between spirituality, school-climate, and substance use, and were constructed using Mplus 7.3 (Muthén and Muthén 2012). Multilevel models account for the interdependence of students nested within the same school. The outcome of interest, past month substance use, was modeled as a latent variable using the three substances described above (i.e., marijuana, prescription drugs, and other substances to get high). Model 1 included both individual- (e.g., turning to spiritual beliefs, stress) and school- level characteristics (e.g., school climate scales, importance of faith, percentage of students receiving free/reduced priced meals, percentage of minority students). Model 2 added an interaction between the stress latent variable and turning to spiritual beliefs for problems. Mplus 7.3 and Stata 13.1 were used for all analyses (Muthén and Muthén 2012; StataCorp 2013). Analyses were further stratified by gender given previous research has found differences between males and females in the relationship between spiritual beliefs and substance

use (Porche et al. 2015; Sebena et al. 2012). Missing data (approximately 13.1% on at least one independent variable) for the substance use outcomes was accounted for by full information maximum likelihood (FIML) in Mplus. FIML is a widely accepted method to handle missing data and assumes data are missing at random. Significance was set at the conventional 0.05 alpha level.

Results

Table 1 presents descriptive statistics of the analytic sample stratified by gender. The average age was approximately 16 years of age (Males $M = 16.0$; Female $M = 15.8$; $p < .001$). The race of participants did not vary significantly by gender; approximately 53% of participants identified as Caucasian. However, there was variation in grade levels between cohort, with significantly higher proportions of females in the lowest grade (9th grade) compared to their male counterparts (29.1 vs. 28.5%; $p = .011$).

With regard to past month substance use, rates differed by gender. About one-fourth of males compared to about one-fifth of females (23.2 vs. 18.5%; $p < .001$) used marijuana in the past month. Similarly, a significantly higher percentage of males compared to females (10.5 vs. 7.3%; $p < .001$) used prescription drugs in the past month. This was also true for other substances, where significantly more males than females (8.1 vs. 4.1%; $p < .001$) reported using other substances to get high.

There were also differences on symptoms of stress within the past month by gender. Specifically, significantly higher proportions of females in comparison to males (69.0 vs. 61.6%; $p < .001$) reported that they never or sometimes have trouble falling asleep. These differences were also observed when queried on whether they did not get enough rest or sleep; a significantly higher percentage of males reported never or sometimes compared to females (45.0 vs. 32.4%; $p < .001$). Females were more likely to report that they feel stressed compared to males (59.4 vs. 39.2% reporting often/almost always; $p < .001$). Additionally, females were more likely to report that difficulties were piling up so high that they could not overcome (41.5 vs. 30.4%; $p < .001$).

There was further variation noted in the sample by gender in relation to spirituality. A significantly higher proportion of females compared to males (68.1 vs. 59.4%; $p < .001$) reported that their faith was somewhat or very important to them. Similarly, the proportion of individuals that agreed or strongly agreed that they turn to their spiritual beliefs when they have personal problems was significantly higher among females compared to their male counterparts (51.0 vs. 47.0%; $p < .001$).

Multivariate Analysis Examining the Associated Influences of Substance Use for Males

Table 2 shows the adjusted structural equation model of stress, spirituality, and past month substance use among male high school students. Model 1 revealed a negative association ($b = -.969$; $p < .001$) between academic performance and past month substance use. Similarly, there was a negative relationship between the percentage of minority students enrolled at the high school and past month substance use ($b = -.015$; $p < .001$). Past month substance use increases ($b = .636$; $p < .001$) with age among male high school students. There was also a positive relationship between stress and substance use; as stress level increases the likelihood of past month substance use increases ($b = .589$; $p < .001$). There was a negative and significant relationship between spirituality and past month substance use; males who agreed or strongly agreed that they turn to their spiritual beliefs when they have personal problems were less likely to report past month substance use ($b = -.358$, $p < .001$).

Model 2 included an interaction between stress and spirituality. The direction nor the significance of the covariates changed with the introduction of the interaction term. The interaction term was positive and significant ($b = .182$,

Table 2 Results for 2-level model examining the association between stress, spirituality, and substance use for males ($n = 12{,}053$)

	Model 1		Model 2	
	b (SE)	*p*	*b* (SE)	*p*
Student-level characteristics				
Age	.636 (.026)	<.001	.639 (.026)	<.001
Race	.128 (.038)	.001	.130 (.038)	.001
Academic performance	−.969 (.078)	<.001	−.966 (.078)	<.001
Spirituality	−.358 (.101)	<.001	−.404 (.105)	<.001
Stress	.589 (.047)	<.001	.692 (.061)	<.001
School-level characteristics				
Importance of faith	.724 (.432)	.094	.729 (.429)	.089
School support	−1.802 (1.069)	.092	−1.799 (1.078)	.095
Perceived safety	.659 (.517)	.202	.656 (.514)	.202
Student connectedness	.596 (.879)	.498	.586 (.876)	.503
% Free/reduced priced meals	−.004 (.004)	.394	−.004 (.004)	.377
% Minority	−.015 (.004)	<.001	−.015 (.004)	<.001
Stress × spirituality			.182 (.081)	.024
R^2 (Within)	.173 (.010)	<.001		
R^2 (Between)	.704 (.098)	<.001		

$p = .024$) such that there was a stronger relationship between stress and substance use among males who agreed/strongly agreed ($b = .653$, $p < .001$) that they turned to their spiritual beliefs when they had personal problems or problems at school compared to those who disagreed/strongly disagreed ($b = .540$, $p < .001$).

Multivariate Analysis Examining the Associated Influences of Substance Use for Females

Table 3 provides results of the female population. Findings from model 1 shows that both school support ($b = -2.798$; $p = .048$) and academic performance ($b = -1.225$; $p < .001$) were associated with a lower odds of past month substance use among female students. Similar to males, there was a positive and significant association between both age ($b = .398$; $p < .001$) and being Caucasian/White ($b = .095$; $p = .011$) and past month substance use. In addition, stress was associated with a higher likelihood of past month substance use ($b = .449$; $p < .001$). Female students who reported that they turned to their spiritual beliefs for problems were less likely to report past month substance use ($b = -.684$; $p < .011$). Model 2 added the interaction term between stress and spirituality which was not significant ($b = -.034$; $p = .649$).

Table 3 Results for 2-level model examining the association between stress, spirituality, and substance use for females ($n = 12{,}171$)

	Model 1		Model 2	
	b (SE)	*p*	*b* (SE)	*p*
Student-level characteristics				
Age	.398 (.039)	<.001	.403 (.039)	<.001
Race	.095 (.038)	.011	.096 (.038)	.011
Academic performance	−1.225 (.016)	<.001	−1.226 (.107)	<.001
Spirituality	−.684 (.092)	<.001	−.694 (.094)	<.001
Stress	.449 (.040)	<.001	.470 (.048)	<.001
School-level characteristics				
Importance of faith	−1.154 (.814)	.156	−1.166 (.822)	.156
School support	−2.798 (1.413)	.048	−2.794 (1.412)	.048
Perceived safety	1.047 (.829)	.207	1.049 (.831)	.207
Student connectedness	−.589 (1.279)	.645	−.595 (1.286)	.644
% Free/reduced priced meals	−.006 (.009)	.453	−.006 (.009)	.454
% Minority	.003 (.006)	.636	.003 (.006)	.626
Stress × spirituality			.034 (.074)	.649
R^2 (Within)	.166 (.012)	<0.001		
R^2 (Between)	.252 (.115)	.029		

Although past month substance use is generally modeled as a binary variable indicating any use within the past month, we decided to assess the association between stress, spiritual beliefs, and substance use without dichotomizing the substance use or the spiritual beliefs variables. Again, the responses for the substance use variable were number of days of substance use (i.e., 0 days, 1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days, and all 30 days). While the strength of the association between stress as well as spiritual beliefs and substance use was attenuated for males ($b = .554$; $p < .001$; $b = -.218$; $p < .001$, respectively) and females ($b = .433$; $p < .001$; $b = -.356$; $p < .001$, respectively), there was no changes in significance of the results. Given these findings, the recoding of the substance use and spiritual beliefs questions did not impact the findings.

Discussion

Adolescents experience developmental changes that influence several aspects of their lives, which can increase levels of stress (Williams and McGillicuddy-De Lisi 1999). Stress can lead adolescents to feel overwhelmed and engage in risky or detrimental behavioral responses, especially if they have little experience with more positive coping mechanisms (Brown et al. 1995; Marlatt and Gordon 1985). Extensive literature demonstrates strong relationships between stress and substance use among adolescents (Charles et al. 2017). This is cause for concern given that substance use can lead to immediate and long-term consequences that lower opportunity and decrease quality of life (Lee et al. 2015).

Many scholars propose that promoting effective coping strategies in adolescence may help them to more effectively and optimally manage stress, and in turn reduce risk for substance use. Moreover, research suggests that spirituality may effectively help adolescents cope with stress, given that it provides meaning for life, and meditation or mindfulness strategies that allow one to reflect and reframe life's setbacks or difficulties in a more positive way (Horton and Luna 2016). Given that similar research on religiosity as a protective factor has revealed inconsistent efficacy for males and females, the current study sought to explore the moderating role of spirituality in the association between stress and substance use by gender in order to further understand this relationship.

The study results indicated that stress increases the likelihood of past month substance use. In line with previous research, the stress-vulnerability (Brown et al. 1995), and the cognitive-behavioral models (Marlatt and Gordon 1985), this finding supports the notion that youth may use substances in response to stressful circumstances (Charles et al. 2017). As expected, our study findings showed an

increase in past month substance use among high school females who had low endorsement of spirituality. In contrast to research examining religiosity among males, our results demonstrated that males reported less substance use when indicating higher levels of spirituality. Overall, results lend further support to the theory that spirituality may serve as a source of strength and enrichment in reducing substance use (McMahon and Biggs 2012) among male and female adolescents.

Similar to national surveys of youth (e.g., YRBS), male students report higher rates of substance use when compared to female students (Kann et al. 2015). Rates of marijuana use in the past 30 days within this sample were also consistent with rates reported by youth in the YRBS. We also found increased likelihood of past month substance use as students age. Prevailing arguments suggest hormonal change coupled with physical growth and greater independence may encourage risky behavior such as substance use during this developmental period (Charles et al. 2015). Moreover, increased substance use was found among Caucasian/White students. This is somewhat in contrast to previous research that generally shows higher rates of substance use among ethnic minority youth (Hill and Mrug 2015). However, this finding could partially be explained by the low rate of substance use among minority female students, which may be partly attributed to greater spiritual beliefs and a history of greater church involvement among this population as compared to Caucasians/Whites (Holt et al. 2015). The current study also demonstrated that positive academic performance was related to reductions in substance use, which is also consistent with other research (Hill and Mrug 2015).

As previously mentioned, and in contrast to our hypothesis, our findings showed that the interaction of spirituality and stress moderated the use of substances among male students only (Sinha et al. 2007), suggesting that spirituality may serve as a stress buffer in reducing the use of substance for male students. It is possible that for males, spirituality may be a more salient protective factor than we have originally thought. Much research has shown strong associations for females and religiosity, but it is also possible that, for male adolescents, general spirituality has a greater role in their behavior. More research is needed to understand what spirituality means to males and how it may be related to their substance use and other risky behaviors.

A similar trend was found for female students when introducing the interaction of spirituality and stress, but it did not reach significance. It is possible that female students' spirituality is a greater influence in other areas of their lives (e.g., sexual behavior, dating relationships; Rostosky et al. 2004). The non-significant finding among females could also be explained by their lower likelihood of engaging in substance use and other risky behavior as compared to their male counterparts to begin with, lessening the need to resort to spiritual measures to reduce stress (Kann et al. 2015).

The current study had some limitations that should be noted. First, the study was based on cross-sectional data. Therefore, causal relationships could not be established. Additionally, this study used a single-item measure of spirituality. As noted by Cotton et al. (2010), a single-item approach, although commonly used in adolescent religiosity literature, is limited in that it does not assess the multidimensionality of spirituality. For example, constructs like spiritual locus of control or religious social support may further explain how faith acts as a protective factor for adolescents (Debnam et al. 2012a, b). Data on students' specific religious backgrounds and denominations were not gathered, nor were students asked about the types of spiritual activities they incorporate into their lives. Exploring this would provide more information as to whether religious affiliation or the engagement in specific activities enhances or deters the beneficial influence of spirituality on stress and substance use. Finally, our findings may not generalize to students outside Maryland. More specifically, most of the schools are located in urban or suburban environments and therefore may not relate to the experiences of adolescents living in rural areas (Scheer et al. 2000). In addition, the demographics of the high schools in this study may differ from other areas of the country; therefore, these students may demonstrate different experiences as it relates to spirituality and substance use (Hill and Mrug 2015). Specifically, in the southern and mid-western areas of the country, religion and spirituality are often characterized as more salient (Ellison and McFarland 2013).

In light of the above limitations, this study provides potentially useful information for parents, religious and youth group leaders. Consistent with the literature, our findings suggest that there is a strong association between stress and substance use for high school students. This illustrates that adolescents experience difficulties coping with stress and some turn to detrimental behaviors, like substance use. Although our study findings show promise for spirituality deterring negative behavioral responses to stress, it is important to consider how parents and practitioners can further enhance the benefits adolescents achieve through their spirituality, and how this can be adapted to the school, community, or home setting in order to include individuals from secular backgrounds as well.

For example, an increasingly popular model for helping adolescents improve coping skills involves mindfulness-based stress reduction. These structured programs focus on enhancing one's non-judgmental awareness of present situations in order to lead to calm and effective problem solving (Sibinga et al. 2014). These programs are also shown to increase one's sense of connection to spiritual or

religious beliefs, given that the meditation and reflection processes can easily incorporate religious practices, such as prayer (Carmody et al. 2008). Additionally, these programs have shown to be effective in treatment programs for individuals of diverse backgrounds, regardless of secular or religious beliefs (Greeson et al. 2015). More research would be needed to determine if this model strengthens the stress reduction that adolescents achieve specifically through their spirituality, and if this serves as a comparable substitute for spirituality among secular adolescents.

Conclusion

Substance use among youth is concerning due to the potential for damaging immediate and long-term consequences (Lee et al. 2015). As shown through this study, substance use correlates with higher stress levels, lending further support to previous studies showing that adolescents use substances to cope with negative situations or emotions (Charles et al. 2017). Our findings also suggest that spirituality may help male adolescents in reacting to stress through more positive behavioral outlets and buffer against substance use. However, it does appear that contextual factors, namely school support, are also highly influential among female adolescents.

Taken together, these findings suggest that adolescents may benefit from education on stress management in a way that incorporates elements of spirituality. Mindfulness-based programs show promise in teaching effective stress reduction practices to adolescents through methods like mediation and mindfulness that are already frequently incorporated in spiritual activities (Greeson et al. 2015). These models and others like them should be further tested in order to determine if benefits in stress reduction through spirituality can be optimized for all adolescents, regardless of secular or religious affiliation.

More research is needed to understand how and under what conditions spirituality is a buffer for stress among male adolescents. Previous studies have mostly focused on the role of various religiosity measures and constructs, but it would be useful to examine how spirituality focused constructs may be developing among male adolescents. Our findings highlight a compelling need to better understand and strengthen positive coping strategies adolescents use to lessen some of the stress they are experiencing in order to prevent substance use.

Funding Support for this study came from the Centers for Disease Control and Prevention (1U49CE000728 & 5U01CE001954-05), the U.S. Department of Education's Safe and Supportive Schools Initiative, the William T. Grant Foundation, and the National Institute of Justice. We thank the Maryland State Department of Education and Sheppard Pratt Health System for their continued support of this research through the Maryland Safe and Supportive Schools Project.

Author Contributions K.D. developed the study, contributed to the study design and analysis, and assisted in drafting the manuscript; A. M. assisted in the study design and analyses, and helped draft the manuscript; M.M. performed literature reviews and helped draft the manuscript; K.L. helped with the study analyses and assisted in drafting the manuscript; C.B. is the principal investigator on the larger study and reviewed drafts of the manuscript and analyses. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval All procedures performed in the current study were in accordance with the ethical standards of the Institutional Review Boards at the Johns Hopkins Bloomberg School of Public Health and University of Virginia, and are consistent with the 1964 Helsinki declaration in order to ensure proper treatment, safety, and confidentiality of all participants.

Informed Consent Passive consent was obtained from parents of students who participated in the study.

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