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# Predicting Adolescents' Intentions to Engage in Fire Risk Behaviors: An Application of the Theory of Planned Behavior

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## ABSTRACT

The current study examined the utility of Ajzen's Theory of Planned Behavior (TPB) in explaining adolescents' intentions to engage in fire-risk behaviors (e.g., using accelerants to start a fire), while controlling for relevant background variables. A total of 222 youth (M age=15.23 years; 69% female) were recruited from public schools in rural and urban areas in the United States. Participants completed questionnaires that assessed fire and burn safety knowledge, TPB components, adolescent psychopathology, parental monitoring, and adolescent risk-taking. Using a multiple regression analysis, the TPB significantly predicted adolescents' intentions to engage in fire-risk behaviors ( $F(3, 193)=40.44, p<.001, R^2=.386$ ). Specifically, adolescents' attitudes toward engaging in fire-risk behaviors ( $\beta=.46, p<.001$ ) and the social pressure they perceived from others (e.g., parents, friends;  $\beta=.19, p<.01$ ) emerged as significant predictors of their intentions to engage in fire-risk behaviors. These results suggest that youth who had positive attitudes (e.g., engaging in fire-risk behaviors is fun) towards fire-risk behaviors and who believed significant others would approve of them engaging in fire-risk behaviors tended to have more intentions to engage in these behaviors. The TPB was able to account for the variance in adolescents' intentions over and above several control/background variables (e.g., SES, gender), with the exception of rebellious behavior ( $\beta=.25, p<0.05$ ). Results from this study can be used to inform the design of effective and targeted fire and burn prevention programs aimed specifically at adolescents.

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## 1. Introduction

Despite numerous prevention efforts, burn injuries still remain a significant health concern for children and

adolescents. Recent estimates suggests that in 2015, approximately 43,000 youth ages 10–19 years were treated for burn injuries in emergency departments across the United States [1]. Adolescents may be at particular risk given developmental changes that occur during this time, such as increased

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independence and less parental supervision. Indeed, older children and adolescents are more likely to sustain burns that are caused by flames and/or hot objects (i.e., contact burns) [2]. The higher prevalence of thermal and contact injuries in adolescents may indicate that adolescents play a more active or causal role in their burn injuries through their own choices and limited judgment, although research in this area is limited. Furthermore, few researchers have examined adolescents' beliefs and attitudes that may be related to engagement in fire-risk behavior. A theoretical model such as Ajzen's Theory of Planned Behavior (TPB) can be used to help explain behaviors that may put adolescents at risk for sustaining burn injuries, such as playing with fire or throwing gasoline on fires [3]. The TPB is particularly relevant when investigating low-frequency behaviors, such as fire-risk behaviors, which are often difficult to predict without extensive, longitudinal research designs.

The TPB suggests that individuals' beliefs can help explain and predict their behavior [3]. Specifically, the theory is comprised of three components: (1) attitude towards the behavior, (2) subjective norm, and (3) perceived behavioral control. These three components are used to predict an individual's behavioral intention to perform a given behavior. Applied to fire risk behaviors in adolescents, *attitude towards behavior* is comprised of the adolescents' beliefs about engaging in fire-risk behavior. For example, youth may believe that building unsafe campfires (e.g., without a clear perimeter) in their backyard is exciting. *Subjective norms* are youth's perception of social pressure to engage or not engage in fire-risk behavior. In the case of adolescents, the social pressure from peers to engage in fire-risk behavior may be higher than the social pressure from adults. For instance, an adolescent assigned the chore of burning brush or trash may be cajoled into using accelerants to get the task done faster so that he or she may join friends for social activities. Finally, *perceived behavioral control* is an individual's sense of control over his or her engagement in fire-risk behaviors. More specifically, perceived behavioral control is an individual's belief in his or her abilities to perform fire-risk behaviors (i.e., self-efficacy). By example, youth may believe that they have control over their own behaviors when they are hanging out at a bonfire with friends. Taken together, the TPB specifies that an individual will intend to perform a fire-risk behavior if an individual holds a positive attitude towards fire-risk behaviors, believes that significant others would approve of them performing fire-risk behaviors, and perceives that the behavior is under his/her control. While these relations between attitudes, subjective norms, and perceived behavioral control may be intuitive, research has yet to examine the three components of the TPB as they relate to adolescent burn injuries [4,5].

Although Ajzen's TPB has not been used to explain adolescent burn injuries, it has been used to explain other health-related behavior in adolescents. Health promotion studies used this theory to examine soda consumption and physical activity in male and female adolescents, with results suggesting that the TPB is an adequate model to predict adolescents' behavioral intentions to drink soda and engage in physical activity [6-8]. Murnaghan and colleagues also examined the utility of the TPB on predicting adolescents' health behaviors (e.g., eating, physical activity, smoking), with results

again demonstrating that the TPB can account for a significant amount of the variance in behavioral intentions to engage in these health-related behaviors [9].

Though these studies provide support for the TPB explaining adolescent health behavior, they failed to consider and control for other variables (e.g., demographic or knowledge variables) that may improve the prediction of adolescents' behavioral intentions and behavior. Research suggests that burn injuries vary as a function of several different variables. For example, males tend to sustain burn injuries more frequently than females, which may be due to a variety of factors (e.g., general interest in fire) [10]. In addition, previous studies suggested that lower SES and geographic location (i.e., urban versus rural areas) may be associated with an increased risk for sustaining burn injuries, as people from lower SES or more urban areas may have less access to things such as functional fire alarms or may be living in overcrowded and/or unsafe environments [10].

Furthermore, although little research has examined the link, it can be assumed that a lack of knowledge regarding fire and burn risk may increase one's risk of sustaining a burn injury. Psychopathology, including attention deficit hyperactivity disorder (ADHD) and sensation-seeking behaviors, also has been found to be significantly related to burn injuries in youth [11,12]. In addition, a lack of parental monitoring has been linked to increased injuries in children and adolescents [13]. To date, researchers have not investigated parental monitoring in relation to adolescent burn injuries, which is surprising given that adolescents tend to experience less parental supervision relative to younger children. Finally, general risk-taking behavior (e.g., underage drinking), which is common in adolescence, may be related to adolescents' behavioral intention to engage in fire-risk behaviors [14].

In sum, it is vital first to understand the various correlates of adolescent fire-risk behavior (using a well-established theory of health behavior) and then use this information to inform the design of developmentally sensitive prevention programs. Indeed, little research has examined fire-risk behaviors in adolescents and few studies have evaluated prevention programs aimed to reduce burn injuries specifically in these youth. The current study's first aim sought to investigate the degree to which the components of the TPB (i.e., attitudes, subjective norms, and perceived behavioral control) predict adolescents' intention to engage in fire-risk behaviors. As suggested by previous studies, it was hypothesized that the three components, individually and combined, would account for a significant portion of the variance in adolescents' intention to engage in fire-risk behaviors. In particular, based on previous literature, it was anticipated that attitudes and subjective norms would be the strongest predictors of behavioral intention [6,7,9]. The second aim addressed the extent to which the TPB components are able to predict adolescents' intention to engage in fire-risk behaviors over and above the influence of relevant background variables (i.e., gender, SES, geographic location, burn and fire safety knowledge, parental monitoring, general risk-taking behavior, and adolescent psychopathology). It was hypothesized that after controlling for these variables, the components of the TPB would sufficiently explain the variance of adolescents' intention to engage in fire-risk

behaviors over and above the potential influence of the background variables.

## 2. Methods

Data were collected from three public high schools in the United States. Institutional review board approval was obtained at all study sites prior to participant recruitment. Prior to examining the aims of this study, qualitative assessment and piloting of our two study measures (i.e., *Fire and Burn Safety Questionnaire* and *TPB Questionnaire*) were completed. These steps were taken to ensure that our measures would be specific and sensitive to fire-burn risk for adolescents.

### 2.1. Participants

A total of 222 youth ( $M$  age = 15.23;  $SD$  = 1.06) were included in this study. Demographic information for this sample is provided in [Table 1](#). Of note, approximately 80% of participants in this study endorsed a past history of sustaining a burn injury, and approximately 8% of participants endorsed a past history of undergoing hospitalization for a burn injury. While the prevalence rate of burn injuries in adolescents who do not seek out medical care is relatively unknown, the hospitalization rate for burn injuries that was endorsed in this study sample seems comparable to the general population [1]. Despite this, these variables were not significantly correlated with the study outcome variables in the final regression models.

Participants were recruited from a convenience sample of local high schools. To enhance the diversity of the sample, approximately half of the participants were recruited from two small town/rural schools in West Virginia ( $n$  = 132), while the other half were recruited from one urban school in Kentucky ( $n$  = 90). The response rates for each of the three schools were 46% and 42% for the West Virginia high schools, and 55% for the Kentucky high school. Participants were excluded from the study if they were non-English speaking or if they had a significant cognitive impairment (e.g., intellectual disability) that precluded them from completing the study questionnaires with minimal assistance.

### 2.2. Measures

#### 2.2.1. Fire and burn injury safety questionnaire (FBISQ)

This questionnaire was designed for the current study to assess youth's knowledge of common fire and burn safety. Participants were asked to respond to 15 open-ended questions and brief vignettes (e.g., "How should you put out a grease fire?", "What, if anything, should you put on your burn injury?"). Given that answers may represent a range of fire and/or safety behavior, this measure allowed participants to respond freely to the questions and vignettes rather than prompt or clue respondents with multiple-choice items. Responses were scored using a coding scheme. Two individual and blinded raters, who were trained by the author of this study, assigned a score to each item response: 1 = high risk, 2 = some risk, and 3 = no/minimal risk. Total scores were calculated by averaging scores across all responses; higher total scores indicated more fire and burn safety knowledge

**Table 1 – Descriptive Statistics for Full Data Collection Demographic Variables.**

	n (%)
Child gender	
Male	66 (29.7)
Female	154 (69.4)
Child race/ethnicity	
Caucasian	185 (83.3)
African American	9 (4.1)
Bi-racial	13 (5.9)
Asian American	6 (2.7)
American Indian/Alaskan Native	1 (0.5)
Other	2 (0.9)
Grade in school	
Ninth	137 (61.7)
Tenth	46 (20.7)
Eleventh	25 (11.3)
Twelfth	10 (4.5)
Grades (academic performance)	
Mostly A's	83 (37.6)
A's and B's	88 (39.8)
Mostly B's	10 (4.5)
B's and C's	30 (13.5)
Mostly C's	3 (1.4)
C's and D's	5 (2.3)
D's and F's	2 (0.9)
Father education level	
High school diploma	67 (31.0)
Some college or specialized vocational training	44 (20.4)
Bachelor's degree	58 (26.9)
Master's degree, doctoral degree	41 (19.0)
Mother education level	
High school diploma	38 (17.4)
Some college or specialized vocational training	62 (28.4)
Bachelor's degree	59 (27.1)
Master's degree, doctoral degree	49 (22.5)
Family status	
Intact, both biological parents	134 (60.6)
Blended (e.g., step-parent)	43 (19.5)
Single parent	44 (19.9)
Ever sustain burn injury?	
Yes	177 (80.1)
No	44 (19.9)
Ever hospitalized for burn injury?	
Yes	18 (8.1)
No	203 (91.4)
All values presented as Frequency (%)	

(i.e., lower risk). As items on this questionnaire assessed a variety of fire and burn safety knowledge, internal consistency of this measure was not calculated.

#### 2.2.2. TPB questionnaire

This questionnaire was designed to examine youth's attitudes, social norms, and perceived behavioral control towards fire-risk behavior. Items for this measure were formatted based on

previously published TPB measures [8,15]. After piloting this questionnaire, a finalized version was created that included 16 items. Results from the pilot data collection indicated that this study specific measure demonstrated adequate psychometric properties (Cronbach's alpha ranged from 0.68 to 0.92).

For this study, "fire behaviors" were defined as "... being involved in an activity that involves any risk for a burn injury." Examples of fire behaviors (e.g., playing with matches, using gasoline to start a fire) were listed on the first page of the TPB Questionnaire, and participants were asked to mark any behaviors that they had engaged in at any time over the course of their lives. Next, behavioral intention was assessed with three items (e.g., "I think I might engage in a fire behavior(s) at least one time over the next three months."). Participants responded on a 4-point Likert-type scale (0=strongly disagree; 3=strongly agree). Items were averaged to yield a total behavioral intention score, with higher scores indicating stronger behavioral intentions to engage in fire-risk behaviors.

Six items were used to examine attitudes towards engaging in fire behaviors (e.g., "I think engaging in fire behaviors is \_\_\_\_"). Participants rated their responses using a 4-response semantic differential scale that included a variety of bipolar adjectives (e.g., very bad/very good). A total attitude score was calculated by averaging the item scores, with higher scores indicating more positive attitude towards fire-risk behaviors. To assess subjective norms, four items were used that measured the opinions of important others in general on adolescents' behavioral intention to engage in fire-risk behaviors (e.g., "I feel pressure from others to engage in fire behaviors."). Participants responded on a 4-point scale for each item (0=strongly disagree; 3=strongly agree). A total score was calculated by averaging the item scores, with higher scores indicating higher ratings of social pressure. Finally, three items were used to evaluate perceived behavioral control. These items assessed self-efficacy and perceived controllability (e.g., "If I wanted to, it would be easy for me to engage in fire behaviors."). Participants responded to these items using a 4-point scale for each item (0=strongly disagree; 3=strongly agree); scores were averaged to obtain a total perceived behavioral control score, with higher scores indicating higher ratings of perceived self-efficacy and controllability.

### 2.2.3. Participant Information Form (PIF)

The PIF was created specifically for this study to gather relevant demographic information (e.g., age, gender, parental education and occupation). Urban/suburban versus rural status was determined based on each participant's hometown. Based on methods used by the United States Census, rural/suburban status was applied to those individuals who reported residing in a hometown of at least 2,500 but less than 50,000 residents [16]. Urban status was assigned to those individuals living in communities larger than 50,000 individuals.

Socioeconomic status (SES) was calculated from parental education levels and occupation titles, which were reported by adolescent participants on the *Participant Information Form*. Using the Hollingshead Four-Factor Index of Social Status, parental education was rated on a 7-point scale, ranging from 1 (less than 7th grade education) to 7 (professional or graduate training [17]). Occupations were rated on a 9-point scale, ranging from 1 (e.g., farm laborers, students, housewives,

maids) to 9 (e.g., higher executives, professors). Both scores are weighted (i.e., education multiplied by 3; occupation multiplied by 5) and summed; in the case of dual-earners in the household, SES was averaged across both earners. Scores using the Hollingshead Index range from 8 to 66, with higher scores reflecting higher SES.

### 2.2.4. Behavior Assessment System for Children – 2nd Edition: Self-Report of Personality-Adolescent (BASC-2: SRP-A, Reynolds & Kamphaus, 2006)

The BASC-2: SRP-A is a self-report questionnaire in a standardized, comprehensive, multi-informant rating system for assessing maladaptive and adaptive behaviors in youth ages 2 through 21 years. The BASC-2 is a well-validated measure that has good psychometric properties as a psychosocial screening tool [18]. The BASC-2: SRP-A yields scores on composite scales (e.g., Externalizing Problems) and subscales (e.g., Sensation-Seeking), as well as validity scores that detect overly negative/positive responses or invalid responding. Raw scores are compared to same-aged boys and girls in the normative sample to yield standard scores ( $M=50$ ;  $SD=10$ ). Participants are asked to complete general statements (e.g., "I like who I am") using a "true" or "false" rating system. They also are asked to complete item stems (e.g., "I am afraid of a lot of things") using a four-point Likert scale (0=never; 3=almost always). Since psychopathology (e.g., ADHD and sensation-seeking behaviors) has been found to be significantly related to burn injuries in youth, age- and gender-based T-scores from the Sensation-Seeking, Attention Problems, and Hyperactivity subscales were used, with higher scores indicating more problematic behaviors [11].

### 2.2.5. Parent/Caregiver Monitoring Scale

This 42-item scale was designed for this study to assess parental/caregiver monitoring. Items were adapted from previously established scales of family rules and parental behavioral control (e.g., *Parental Restrictive Control Questionnaire*), parent solicitation, and adolescent disclosure [19,20]. As a lack of parental monitoring has been linked to increased injuries in youth, this study examined three components of parental monitoring: parental solicitation, adolescent self-disclosure, and parental behavioral control [13]. Participants responded using a 5-point Likert-type scale, with a score of 0 corresponding to 'never' and a score of 4 corresponding to 'always.' In this study, total scores were calculated by averaging scores from the parental solicitation, adolescent self-disclosure, and parental behavioral control items, with higher scores indicating more parental solicitation, adolescent self-disclosure, and parental behavioral control, respectively. With the current sample, Cronbach's alphas for each of the three subscales were good: parental solicitation (0.85); child self-disclosure (0.86); and parental behavioral control (0.89).

### 2.2.6. Adolescent Risk-Taking Questionnaire

The *Adolescent Risk-Taking Questionnaire* (ARQ) is a 22-item checklist that assesses adolescent thrill-seeking (e.g., inline skating), rebellious (e.g., underage drinking), reckless (e.g., drinking and driving), and antisocial (e.g., overeating) behaviors [21]. Using a 5-point scale, participants rate how often they engage in the described behaviors, ranging from 0 (never) to 4 (very often). For the purposes of this study, only items included

in the Rebellious (5 items) and Reckless Behavior (5 items) subscales were administered. Total scores for these subscales are computed by averaging scores for each subscale, with higher scores indicating more rebellious or reckless behavior. The ARQ has demonstrated appropriate psychometric properties, with Cronbach's alphas greater than 0.80 for both the reckless and rebellious subscales [21]. In the current study, Cronbach's alpha for the Rebellious Subscale was 0.86, while the Cronbach's alpha for the Reckless Subscale was 0.54.

### 2.3. Procedure

Research team members approached potential participants during their class periods. Research staff described the study and its procedures, potential risks and benefits, and how confidentiality would be protected. Participants 17 years and younger were given a parent consent form and an adolescent assent form; participants 18 years and older were given an adolescent consent form. A few days later, students who provided written assent and a parent's consent completed the study measures during a class period. The questionnaires took participants approximately 25 to 45 minutes to complete. For their participation, students each were entered into a drawing to win one of 20, \$20 gift cards.

### 2.4. Statistical analyses

To examine the first aim, a multiple regression analysis was conducted that included the three components of the TPB (i.e., attitude, subjective norm, and perceived behavioral control) entered simultaneously as predictors of behavioral intention to engage in fire-risk behaviors. For the second aim, a hierarchical multiple regression analysis was calculated that included the various control variables (i.e., SES, geographic location, gender, sensation-seeking, hyperactivity, attention problems, fire and burn safety knowledge, parental solicitation, child self-disclosure, parental behavioral control, reckless behavior, and rebellious behavior) as the first step of the model, while the three components of the TPB were entered in the second step of the model. Behavioral intention to engage in fire-risk behaviors was the dependent variable.

Prior to data analyses, all data were checked for issues with missing values, violations of normality and homogeneity, and possible outliers. The BASC-2 provides a variety of validity scores, which range from acceptable, caution, and extreme caution. Participants whose scores indicated extreme (i.e., validity scores were caution and/or extreme caution) carelessness and inconsistency were excluded from analyses that used the BASC-2 scores. This excluded a total of 14 participants from the analyses. Means and standard deviations of all study variables are presented in Table 2. Means and standard deviations of the BASC-2 standard scores are presented in Table 3 to provide additional descriptive information on the study sample.

An *a priori* power analysis was conducted to determine how many participants would be required to sufficiently power this study in its third phase. Based on previous TPB literature, which suggested a medium effect size, an effect size of 0.15 was used to conduct a power analysis [8]. Using a power level of 0.80 and an alpha level of 0.05, it was determined that the current study would require a minimum of 103 participants. Thus, this study was sufficiently powered to determine statistical significance.

## 3. Results

The first aim was to investigate the degree to which the components of the TPB predict adolescents' intentions to engage in fire-risk behaviors. Together, the combined TPB components significantly predicted youth's behavioral intentions to engage in fire-risk behaviors,  $F(3, 193)=40.44, p < .001$ . This model accounted for 38.6% amount of variance (Adj.  $R^2=.38$ ). Further examination of individual predictors revealed that attitude towards behavior ( $\beta=.46, p < .001$ ) and subjective norms ( $\beta=.19, p=.005$ ) were significant predictors of youth's intention to engage in risky fire behaviors (see Table 4), suggesting that youth who held positive attitudes towards fire-risk behaviors and who believed significant others would approve of them engaging in fire-risk behaviors tended to have more intentions to engage in fire-risk behaviors. Perceived behavioral control was not a significant predictor of youth's intentions to engage in risky fire behaviors.

**Table 2 – Means and Standard Deviations of Study Variables.**

Measure	M	SD	Range	Cronbach Alpha
TPB-Intentions	4.79	2.72	0-9	0.92
TPB-Attitude toward Behavior	8.45	3.59	0-18	0.92
TPB-Subjective Norms	2.84	2.17	0-8	0.82
TPB-Perceived Behavioral Control	4.28	1.42	0-6	0.68
BASC-2: Sensation Seeking*	11.67	4.62	1-26	
BASC-2: Hyperactivity*	7.04	4.34	0-42	
BASC-2: Attention Problems*	8.10	5.44	0-41	
Fire and Burn Injury Safety Questionnaire	34.90	3.68	22-43	0.48
Parental Solicitation	25.66	11.48	0-56	0.85
Child Self-Disclosure	21.16	11.90	0-76	0.86
Parental Behavioral Control	31.68	10.83	1-56	0.89
Rebellious Behavior	0.26	0.42	0-3.4	0.86
Reckless Behavior	0.77	0.77	0-4	0.55

\*Cronbach alphas were not calculated for the BASC-2 subscales, as the BASC-2 includes validity items that detect inconsistent responding.

**Table 3 – Means and Standard Deviations of BASC-2 Standard Scores.**

BASC-2 Subscale	M	SD	Range
Sensation Seeking	50.00	10.60	26-79
Hyperactivity	52.81	10.78	33-84
Attention Problems	51.20	11.33	34-82
Mean for standard scores=50; SD=10.			

**Table 4 – Multiple Regression Analysis Predicting Fire-Risk Behavioral Intentions from TPB Components.**

Predictor	B	Std. Error	$\beta$	t
TPB-Attitudes	.701	.106	.463	6.60**
TPB-Subjective Norms	.313	.111	.188	2.82**
TPB-Perceived Behavioral Control	.109	.077	.087	1.43
F	40.44			
Total R <sup>2</sup>	.386			
n	197			

\*  $p < .05$ .  
\*\*  $p < .01$ .

To evaluate the second aim, a hierarchical regression analysis was conducted that examined the three TPB components as predictors of fire-risk behavioral intentions while controlling for various background variables. Results suggested that the first step of the model (background variables) accounted for a significant amount of variance in youth's behavioral intentions,  $F(12, 151)=2.86$ ,  $p=.001$ ,  $R^2=.19$  Adj.  $R^2=.12$ ; however, rebellious behavior was the only significant predictor of adolescents' behavioral intentions in Step 1 of the model,  $\beta=.34$ ,  $p<.001$ . Step 2 of the model (addition of TPB components) significantly accounted for an additional 26.3% ( $R^2$  change=.263) of the variance in youth's behavioral intentions,  $F(15, 148)=8.01$ ,  $p<.001$ ,  $R^2=.45$  Adj.  $R^2=.39$ . As shown in Table 5, rebellious behavior, attitude towards the behavior, and subjective norms were significant predictors of adolescents' intentions to engage in fire-risk behaviors. Along with rebellious behavior, components of the TPB (i.e., attitudes towards behavior and subjective norm) were able to account for approximately 26% of the variance in behavioral intentions to engage in fire-risk behaviors. More specifically, youth with higher rebellious behavior, more positive attitudes towards fire-risk behaviors, and youth with more perceived social pressure from important others tended to endorse more intentions to engage in fire-risk behaviors.

#### 4. Discussion

Recent estimates suggest that approximately 43,000 youth ages 10-19 years were treated for burn injuries in emergency departments across the United States in 2015 [1]. Due to the serious consequences of burn injuries (i.e., hospitalization, painful medical treatments, rehabilitation, and permanent

scarring), prevention programs are needed that address the specific developmental needs of adolescents. However, few adolescent burn prevention programs have been developed thus far. Not only is there a dire need for fire and burn prevention programs specifically tailored to adolescents, but these programs should be rooted in scientific findings. Theories of health behavior, such as Ajzen's Theory of Planned Behavior (TPB), can be used to help understand why adolescents may engage in behaviors that put them at risk for sustaining a burn injury. Previous research using the TPB has demonstrated the utility of this model in predicting variance in youth's behavioral intentions to engage in a variety of health behaviors (e.g., soda consumption, physical exercise) [6,8]. In addition to examining the application of the TPB to adolescents' behavioral intentions to engage in fire-risk behaviors, this study also examined the ability of the components of the TPB to predict adolescents' intention over and above a variety of control or background variables, all of which are relevant and/or have been shown to be related to burn injury outcomes [10,22].

As hypothesized, the TPB components were significant predictors of adolescents' behavioral intentions to engage in risky fire behaviors and accounted for 38.6% of the variance in this outcome. Previous studies using the TPB to predict various adolescent health behaviors have found similar results, with the amount of variance ranging from 33.7% to 64% [6,8]. Consistent with previous literature, the TPB components of subjective norms and attitude towards behavior emerged as significant predictors of this relation. Developmentally, adolescence is a time where social pressure (i.e., subjective norms) and attitude formation may play a role in determining adolescent behavior – particularly health risk behavior [8,9].

Surprisingly, perceived behavioral control (i.e., individuals' control of their behaviors around fire-risk behaviors) was not a significant predictor of adolescents' intention to engage in fire-risk behaviors. While previous studies using the TPB demonstrated that this variable was a significant predictor of adolescents' behavioral intentions to engage in various health behaviors [9], it could be that fire-risk behaviors occur at a relatively low frequency (e.g., individuals may have campfires only occasionally during the year or use fireworks only at holidays) and thus adolescents do not feel competent (or confident) in their skills to control these behaviors. It could also be that adolescents perceive fire and burn injuries as accidents and as a result, view burn-fire risk as something that is externally controlled (e.g., bad luck). Nonetheless, further research is needed to clarify the role of perceived behavioral control in fire-risk behaviors, as this information could inform the development of prevention programs. For example, if perceived behavioral control was found to be a significant predictor of behavioral intentions (either high or low perceived behavioral control), a skills-based approach (e.g., how to properly start a campfire) could be used to teach youth how to be safe (i.e., have more control) around situations that pose risks for fire and/or burn injuries (e.g., campfires).

In addition, as hypothesized, the TPB components significantly accounted for more variance in adolescents' intention to engage in fire-burn risk behavioral intentions over and above a variety of factors. Rebellious behavior also was found to be a significant predictor of youth's behavioral intentions to

**Table 5 – Hierarchical Regression Analysis Predicting Fire-Risk Behavioral Intentions from TPB Components while Controlling for Various Background Variables.**

Predictor	$\Delta R^2$	B	Std. Error	$\beta$	t
Step 1	.000				
BASC-Sensation Seeking		-.001	.008	-.016	-.171
BASC-Attention		.006	.007	.081	.873
BASC-Hyperactivity		.007	.008	.089	.888
SES		.005	.006	.069	.893
Geographic Location		.131	.149	.073	.882
Gender		.238	.150	.120	1.584
Reckless Behavior		.238	.192	.117	1.238
Rebellious Behavior		.380	.117	.339**	3.256
Fire and Burn Injury Safety Quest.		.075	.284	.020	.265
Parental Solicitation		-.093	.128	-.085	-.724
Parental Behavioral Control		.072	.111	.062	.647
Child Self-Disclosure		.018	.111	.017	.162
Step 2	.263**				
BASC-Sensation Seeking		-.001	.738	-.007	-.088
BASC-Attention		.008	.006	.098	1.281
BASC-Hyperactivity		-.007	.006	-.081	-.939
SES		.000	.007	.006	.095
Geographic Location		.232	.005	.129	1.864
Gender		.000	.125	.000	.001
Reckless Behavior		.170	.131	.084	1.063
Rebellious Behavior		.251	.160	.225*	2.529
Fire and Burn Injury Safety Quest.		-.026	.099	-.007	-.108
Parental Solicitation		-.023	.239	-.021	-.203
Parental Behavioral Control		.124	.114	.107	1.290
Child Self-Disclosure		-.027	.096	-.025	-.285
TPB-Attitudes		.560	.131	.363**	4.265
TPB-Subjective Norms		.471	.126	.286**	3.751
TPB-Perceived Behavioral Control		.027	.094	.022	.293
F	8.01				
Total R <sup>2</sup>	.448				
n	164				

\*  $p < .05$ .

engage in fire-risk behaviors. Adolescence is a time characterized by increased risk-taking behavior, which may help explain why rebellious behavior was a significant predictor of behavioral intentions in the current sample of adolescents [14]. It is likely that adolescents who tend to engage in rebellious behaviors (e.g., drinking, smoking) are also more likely to engage in fire behaviors, a similarly risky behavior.

Regardless of the background variables included in the model, the TPB components of attitude towards the behavior and subjective norms were significant predictors of adolescents' behavioral intentions to engage in fire-risk behaviors. More specifically, results suggested that youth who held more positive attitudes towards fire-risk behaviors and youth who perceived more important others would approve of them engaging in fire-risk behaviors tended to endorse more intentions to engage in fire-risk behaviors. Although results from this study are somewhat intuitive, adolescent fire-risk behaviors have yet to be investigated and documented through sound research. As such, these results are quite meaningful, and can greatly inform the development of prevention programs. For example, prevention programs could target adolescents' attitudes as well as address methods to resist social pressure to engage in fire-risk behaviors, rather

than focus solely on education about potential burn risk and fire safety behavior.

Indeed, burn prevention programs for youth are quite limited in their content and typically target fire and burn prevention knowledge [23]. Because of the limited research in this area, results from this study provide a large step towards developing a scientifically based fire and burn prevention program for teenagers. Prevention programs that target other health behaviors in adolescents (e.g., alcohol use) do a much better job of addressing a variety of factors in addition to knowledge, such as targeting social influences, attitudes, and norms as well as training in social refusal skills [24]. It is not surprising then that results from the current study suggest that including components such as attitudes toward fire-burn risk behavior and addressing perceived social pressure (as some studies do) might enhance the effectiveness of fire and burn prevention for adolescents. Targeting these factors may lead to a decrease in adolescent intentions to engage in fire-risk behaviors, which in turn may reduce the frequency of fire and burn related injuries in this population.

Another key implication of the study is the potential utility of the results to inform the development of brief screening measures and interventions for fire-risk behaviors in

adolescents. For instance, the *TPB Questionnaire* from this study may be used with children in primary care clinics to assess their knowledge and beliefs about fire behaviors. As most primary care clinics review various safety strategies with patients and their parents, fire-risk screening measures could be used as part of the review of safety strategies and provide more specific information that is tailored to the individual patients' needs, such as their attitudes towards fire-risk behaviors. Screening measures may also help identify patients who could benefit from additional resources (e.g., outpatient counseling) and subsequent interventions (e.g., assertiveness training to resist peer pressure around fires).

This study was not without limitations. First, only adolescents completed study measures; the inclusion of parent-report and/or objective ratings of behaviors may have provided additional information or perspectives on participants' engagement in fire-risk behaviors. As only adolescents completed the self-report measures, shared-informant and shared-method variance may have increased the likelihood of finding significant results. In addition, several of the measures used in this study were created for the purposes of the study. It was beyond the scope of this project to thoroughly evaluate the psychometric properties of these measures; thus, results should be interpreted with caution, and future studies should continue to examine the psychometric properties of these measures. Specifically, a few measures (i.e., *Fire and Burn Injury Safety Questionnaire*, *Adolescent Risk-Taking Questionnaire*) had limited internal consistency, which may have reduced the predictive ability of these measures with respect to adolescents' fire risk behavior intentions.

Other limitations may be due to participant characteristics. Given the sensitive nature of some of the questionnaires (e.g., evaluation of fire-risk and other risky behaviors), participants may have responded in socially desirable ways. In addition, participants were recruited mostly from health classes and thus may have been previously exposed to injury prevention topics. Furthermore, the cross-sectional design of the study prevents any causal inferences. Yet, previous TPB research suggests that self-report of behavioral intentions can account for significantly more variance compared to objective reports of behaviors [25]. It is important to note that this study did not measure actual or objective engagement in fire-risk behavior and so it is unclear if behavioral intentions to engage in fire-risk behaviors are a significant predictor of adolescents' engagement in these behaviors. Future longitudinal research can examine the relation between reported behavioral intentions with objective measurements of behavior (i.e., incidence of burn injuries); however, such research will need to incorporate large samples to capture sufficient data.

As this was one of the first studies to use a theoretical basis to examine factors associated with adolescents' intention to engage in fire-risk behaviors, future research should continue to investigate attitudes, subjective norms, and perceived behavioral control, as well as other variables that may be associated with adolescents' fire-risk behavioral intentions, such as perceived threat of burn injuries, cultural practices, family dynamics and routines, or affect. In addition, examination of fire-risk behaviors using other

theories of health behaviors (e.g., Health Belief Model) may provide additional insight into fire-risk behaviors. It is imperative that future research continues to evaluate fire-risk behaviors during adolescence, as a greater understanding of this behavior can be used to inform the development of effective and targeted fire and burn prevention programs for teenagers.

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## Declarations of interest

None.

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## REFERENCES

- [1] Unintentional Fire/Burn Fatalities and Nonfatal Injuries, Children Ages 19 and Under. [cdc.org.http://www.cdc.gov/injury/wisqars/index.html](http://www.cdc.gov/injury/wisqars/index.html). [Assessed June 23, 2017].
- [2] Kagan RJ, Peck MD, Ahrenholz DH, Hickerson WL, Holmes J, Korentager R, Kraatz J, Pollock K. Kotoski: Surgical management of the burn wound and use of skin substitutes: An expert panel white paper. *J Burn Care Res* 2013;34:60-79.
- [3] Ajzen I. The theory of planned behavior. *Organ Behav Hum Decis Process* 1991;50:179-211.
- [4] Ajzen I. From intentions to actions. In: Ajzen I, editor. *Attitudes Personality and Behavior-2nd Edition*. New York: NY: Open University Press; 2005. p. 99-116.
- [5] Ajzen I. Explaining intentions and behavior. In: Ajzen I, editor. *Attitudes, Personality and Behavior-2nd Edition*. New York: NY: Open University Press; 2005. p. 117-41.
- [6] Kassem NO, Lee JW, Modeste NN, Johnston PK. Understanding soft drink consumption among female adolescents using the theory of planned behavior. *Health Educ Res* 2003;18:278-91.
- [7] Kassem NO, Lee JW. Understanding soft drink consumption among male adolescents using the theory of planned behavior. *J Behav Med* 2004;27:273-96.
- [8] Keats MR, Culos-Reed SN, Courneya KS, McBride M. Understanding physical activity in adolescent cancer survivors: An application of the theory of planned behavior. *Psychooncology* 2007;16:448-57.
- [9] Murnaghan DA, Blanchard CM, Rodgers WM, LaRosa JN, MacQuarrie CR, MacLellan DL, Gray BJ. Predictors of physical activity, healthy eating and being smoke-free in teens: a theory of planned behavior approach. *Psychol Health* 2010;25:925-41.

- [10] Peck MD. Epidemiology of burns throughout the world: part I: distribution and risk factors. *Burns* 2011;37:1087–100.
- [11] Badger K, Anderson L, Kagan RJ. Attention deficit-hyperactivity disorder in children with burn injuries. *J Burn Care Res* 2008;29:724–9.
- [12] Piazza-Waggoner C, Dotson C, Adams CD, Joseph K, Goldfarb IW, Slater H. Preinjury behavioral and emotional problems among pediatric burn patients. *J Burn Care Rehabil* 2005;26:371–8.
- [13] Carrigan L, Heimbach DM, Marvin JA. Risk management in children with burn injuries. *J Burn Care Rehabil* 1988;9:75–8.
- [14] Reyna VF, Farley F. Risk and rationality in adolescent decision making: Implications for theory, practice, and public policy. *Psychol Sci Public Interest* 2006;7:1–44.
- [15] Francis JJ, Eccles MP, Johnston M, Walker A, Grimshaw J, Foy R, Kaner EFS, Smith L, Bonetti D. Constructing questionnaires based on the theory of planned behavior: A manual for health services researchers. Newcastle upon Tyne: University of Newcastle; 2004.
- [16] Urban and Rural Classification. census.gov. <http://www.census.gov/geo/reference/urban-rural.html>. Assessed 2013.
- [17] Hollingshead AB. Four factor index of social status. 1975 Unpublished manuscript.
- [18] Reynolds CR, Kamphaus RW. BASC -2: Behavior Assessment for Children. Second Edition Upper Saddle River, NJ: Pearson Education Inc; 2006.
- [19] Smetana JG, Daddis C. Domain-specific antecedents of parental psychological control and monitoring: The role of parenting beliefs and practices. *Child Dev* 2002;73:563–80.
- [20] Smetana JG, Metzger A, Gettman DC, Campione-Barr N. Disclosure and secrecy in adolescent-parent relationships. *Child Dev* 2006;77:201–17.
- [21] Gullone E, Moore S, Moss S, Boyd C. The Adolescent Risk-Taking Questionnaire: Development and psychometric evaluation. *J Adolesc Res* 2000;15:231–50.
- [22] Patterson DR, Finch CP, Wiechman SA, Bonsack R, Gibran N, Heimbach D. Premorbid mental health status of adult burn patients: comparison with a normative sample. *J Burn Care Res* 2003;24:347–50.
- [23] Grant E, Turney E, Bartlett M, Winbon C, Peterson HD. Evaluation of a burn prevention program in a public school system. *J Burn Care Rehabil* 1992;13:703–7.
- [24] Kulis S, Nieri T, Yabiku S, Stromwall LK, Marsiglia FF. Promoting reduced and discontinued substance use among adolescent substance users: effectiveness of a universal prevention program. *Prev Sci* 2007;8:35–49.
- [25] Armitage CJ, Conner M. Efficacy of the theory of planned behavior: a meta-analytic review. *Br J Soc Psychol* 2001;40:471–99.