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Adolescent risk-taking behaviors, including substance use and risky sexual behaviors, contribute to the leading causes of death and disability among youth and adults (CDC, 2020). It is important to understand developmental and contextual variables that predict risk-taking behaviors to mitigate harmful outcomes and inform prevention efforts. Developmental literature has considered childhood temperament as it relates to risk-taking behavior in adolescence. Specifically, temperamental surgency has been linked to risk-taking outcomes (e.g. Youssef et al., 2016; Cooper et al., 2001; Honomichl & Donnellan, 2012). Peer popularity has also been positively associated with risk-taking outcomes in adolescence due, in part, to increasing salience in social rewards and motivations for high peer status (Brechwald & Prinstein, 2011). While sex differences in the association between popularity and risk-taking have been noted in the literature (e.g. Prinstein et al., 2011), little is known about sex differences in childhood surgency and how potential differences may be related to risk-taking behaviors. Therefore, this study examined sex differences in the association between surgency, self-perceived popularity, and risk-taking. Using a sample of 271 children (125 males, 146 females) at 4 and 15-year assessments, we examined whether the association between early temperamental surgency (age 4) and its relation to risk-taking (age 15), is moderated by self-perceived popularity (age 15) and sex. Results of the three-way interaction indicated a significant association between surgency, self-perceived popularity, and sex predicting risk-taking in adolescence; the association between surgency and risk-taking was exacerbated at high levels of self-perceived popularity for females only. Implications for prevention and intervention efforts in the context of peer relationships are discussed.

# THE ASSOCIATIONS AMONG CHILDHOOD SURGENCY, SELF-PERCEIVED POPULARITY, AND ADOLESCENT RISK-TAKING BEHAVIORS CONSIDERING SEX DIFFERENCES

by

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# DEDICATION

*I would like to dedicate this thesis to my parents, best friends, cohort members, and fellow lab members that supported me through the many hours of work that went into this project. I couldn't have done it without all your love and encouragement!*

APPROVAL PAGE

This thesis written by Jaclyn A. Yuro has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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# CHAPTER I: INTRODUCTION

## Risk-Taking Behaviors

Adolescent risk-taking behaviors, including substance use and risky sexual behaviors, contribute to the leading causes of death and disability among youth and adults (Center for Disease Control and Prevention, 2020). National data from the most recent report of the 2021 Youth Risk Behavior Survey (YRBS) shows that 23% of high school students have had a drink of alcohol in past month, 18% have used an electronic vapor product in the past month, 30% of high school students have had sexual intercourse, and 16% have used marijuana in the past month (CDC, 2023). Despite a steady decrease in cigarette use over the past decade, e-cigarettes have become popular among teens, showing an even greater prevalence than traditional cigarette use (Kann et al., 2018). Based on these statistics, it is clear that engaging in substance use and risky sexual behavior is common among adolescents.

Engaging in risky behavior has detrimental short-and-long term effects, such as injury, accidents, sexually transmitted diseases, unwanted pregnancies, and addictions, though these are ultimately preventable (CDC, 2018). Moreover, earlier engagement in risk-taking behaviors has been linked to increased mental health problems in adolescence and beyond (e.g. McGue and Iacono, 2005; Vasilenko et al., 2016). Given that substance use and sexual risk-taking commonly co-occur in adolescence (Connell et al., 2009; King et al., 2012), it is critical to study developmental factors and contextual variables that predict these risk-taking behaviors in order to mitigate harmful outcomes.

Previous research has considered both individual child and environmental factors as they relate to later risk-taking behavior. This work includes developmental, cognitive, behavioral, and

social approaches to understanding risky behavior, though there is still work to be done (e.g. Romer, 2010; France, 2000; Do et al., 2019; Steinberg, 2011; Romer et al., 2017). Understanding factors which contribute to adolescents' increased risk for engaging in these behaviors requires knowledge of early developmental pathways.

## Temperament / Surgency

Childhood temperament is one important individual developmental factor to consider in predicting risk-taking behaviors. Temperament has been conceptualized as individual differences in reactivity and regulation that emerge early in life and are relatively stable over time (Rothbart & Bates, 2006). Research has shown moderate stability of temperament from early childhood into adolescence (e.g. Kopala-Sibley et al., 2018), though there are many other environmental factors, such as parenting, that likely affect the development of temperament. Temperament, discussed in the developmental literature, includes three overarching dimensions including surgency/extraversion, effortful control, and negative emotionality. Surgency/extraversion is characterized by high activity level, high approach motivation, high-intensity pleasure, and low shyness (Rothbart & Putnam, 2002; Rothbart 2011), and includes the relational characteristics of sociability, social dominance, and lack of shyness (Shiner & Caspi, 2002). Surgency is similar to the construct of temperamental exuberance, although surgency is typically considered on a continuum, while exuberance is typically considered as a categorical variable (e.g. high vs. low). A child with a high level of surgency/extraversion is outgoing, quick to approach strangers and new situations, seeks exciting activities, and exhibits intense positive emotions. Surgency is less studied than other temperament dimensions in the literature and has mixed findings as it relates to both adaptive and maladaptive outcomes (Stifter & Dollar, 2016).

**Surgency and Risk-Taking Behaviors**

Although there is literature to suggest that surgency is related to adaptive outcomes (e.g. Fox & Henderson, 1999; Cohen & Pressman, 2006; Janssen et al., 2017; Shiner et al., 2004), there is a substantial literature that confirms the association between surgency and negative outcomes, including risk-taking. Specifically, surgency and components of surgency, have been linked to substance use and sexual risk-taking in teens and adults (Colder et al., 2012; Creemers et al., 2010; Dollar et al., 2022; Hoyle et al., 2000; Lauriola and Weller 2018; Honomichl & Donnellan, 2012; Youssef et al., 2016; Cooper et al., 2001; Lahat et al., 2012). In the literature, surgency has been measured using terms such as "surgency" or "extraversion", as well as components of this broad temperament dimension, such as "high intensity pleasure", "impulsivity", "social approach" (i.e. low shyness), and "activity level". For example, in 10–12-year-olds, high intensity pleasure and low shyness predicted lifetime marijuana use at age 15-18 years old (Creemers et al., 2010). Dollar et al (2022) found that high-intensity positivity at age 5 was associated with a composite variable of minor risk-taking, which included substance use and sexual risk-taking, at 15. Another study showed reward sensitivity through approach motivation was related to increased substance use in a group of eleven-year-olds (Colder et al., 2012). In adults, impulsivity, novelty-seeking, and extraversion are related to risky sexual behaviors (Hoyle et al., 2000). Further, the high-order dimension of surgency was positively related to a composite risk-taking score, which included daily smoking behavior, cannabis use, alcohol use, sexual partners at age 16 (Youssef et al., 2016), and it predicted heavy-drinking and risky sexual behaviors in a group of 18–25-year-olds (Cooper et al., 2001). Surgency at 54 months was also positively associated with a risk-taking composite at 15 years (Honomichl & Donnellan, 2012). While further examination of specific components of surgency could yield important findings,

examining the higher order construct is necessary to allow for a greater understanding of the full affective-motivational system at play; that is, understanding how all the components of surgency work together to influence risk-taking outcomes (Putnam et al., 2001).

Despite the clear evidence that surgency is related to risk-taking, especially substance use and risky sexual behaviors, questions still remain about for whom and under what circumstances childhood surgency relates to risk-taking behaviors. No research, to my knowledge, has examined longitudinal relations between early childhood surgency and adolescent risk-taking behaviors while taking into account environmental factors, such as peers, who likely play a role in this association.

## Peer Influence in Adolescence

In addition to the role of early individual factors, peers are a developmentally relevant component of the adolescent social context, which suggests another correlate of adolescent risk-taking. During adolescence, peer relationships and their influence become increasingly salient as teens spend more time in this social context (Steinberg & Morris, 2001; Brown & Larson, 2009). Much work to date has established the nature of this transition. As individuals transition from childhood into early adolescence, there are new individual and social expectations and demands that increase the importance of peers. In addition, in mid-adolescence, there is less influence by parents and other adults, as peers take an increasingly important role in shaping behavior. The transition to high school, therefore, may be an especially important developmental period to consider. Peer relationships also become more complex into adolescence with the consideration of close friendships, romantic partners, bullies, etc. Peer group dynamics become more notable and peer status and prestige affects the attitudes and behaviors of the individual, both negatively and positively (Brown & Larson, 2009).

There is an extensive body of literature that seeks to understand the mechanisms that link various types of peer influence to risk-taking in adolescence. First, social learning theory explains that adolescents learn to adopt the behaviors of valued peers based on social rewards, punishment, and reinforcement, in pursuit of similar status (Bandura, 1986). A related, yet separate, literature considers identity-based theories which describe that the emulation of behaviors within a valued reference group leads to positive sense of self, and is intrinsically rewarding (Abrams & Hogg, 1990; Festinger, 1954). Relatedly, another theory in the developmental neuroscience literature emphasizes that during middle adolescence, there is a heightened vulnerability toward risk-taking in the presence of peers due to increased sensitivity to rewarding social-emotional stimuli that pairs with an immature cognitive control system (Albert & Steinberg, 2011). Consistent with this view, research has shown that teens respond to social evaluation with heightened emotional intensity (Sommerville, 2013), and adolescents prefer immediate over delayed rewards in the presence of peers (O'Brien et al., 2011). It is clear that adolescents learn from the affect and behavior exhibited by valued peers and adopt these behaviors in order to receive the extrinsic and intrinsic rewards that follow.

**Popularity and Risk-Taking**

Following from the theories above, popular adolescents are the valued peer group for many teens (LaFontana & Cillessen, 2009). In adolescence, "popularity" relates to the idea of visibility, prestige, and social dominance, and as such, higher peer status and popularity are associated with various risk-taking behaviors (Brechwald & Prinstein, 2011). It is not surprising, therefore, that popular teens engage in more risk-taking behaviors than their unpopular peers (e.g. Mayeux et al., 2008; Hawke & Reiger, 2013; LaGreca et al., 2001; Rebellon et al., 2018). For example, perceived popularity in 10$^{th}$ grade predicted increased alcohol use and sexual

activity in 12th grade, for both boys and girls (Mayeux et al., 2008), and popularity in 9th grade was associated with various forms of risk-taking, including but not limited to, alcohol use and sexual intercourse (Hawke & Reiger, 2013).

### *Self-perceived Popularity*

While peer-perceived and sociometric popularity are often used to examine links to risk-taking outcomes in adolescence, teens' self-perceived popularity may also be an important construct to consider. Despite less examination of this construct, there is some evidence to suggest its unique importance to adolescent outcomes (e.g. Putarek & Keresteš, 2015; Mayeux & Cillessen, 2008). Individuals are likely to engage in behaviors related to their beliefs about a situation, despite the objective accuracy. Some evidence suggests that teens who perceive themselves as popular engage in risk-taking behaviors that are normative within their popular peer group to perpetuate their perceived status (Mayeux & Cillessen, 2008). In this way, popularity motivations may drive increases in subsequent risk-taking (Dumas et al., 2017). There is some, albeit limited, evidence to suggest that self-perceived popularity may predict risk-taking behavior, such as heavy drinking, over and above peer-rated popularity (Blustein, 2017; Dumas et al., 2017).

## Friends' Risk-Taking

Based on the current literature, one of the most robust predictors of teens' engagement in negative risk-taking behavior is their friends' engagement in negative risk-taking behaviors (e.g. Prinstein & Cillessen, 2003; Dishion and Owen 2002; Hawkins et al. 1992). Having a friend group that engages in risk-taking behaviors, such as alcohol use (Henry et al., 2005), other substance use (Piehler et al., 2012) and sexual risk-taking (Widman et al., 2016) socializes the individual to the behavior, making it likely that the adolescent will also engage in these

behaviors. However, despite the relevance of friends' risk-taking generally, the measurement of friends' risk-taking does not take into account the type of peer group that is influencing behavior, such as popular, jocks, brains, burnouts, nonconformists, or others (La Greca et a., 2001), and therefore, doesn't consider the social and emotional experience of the teens. In this way, different mechanisms may be at play depending on which peer group adolescents are aligning with (Giletta et al., 2021). While friends' engagement in risk-taking is not a main variable of interest in this study, it is considered as a covariate in order to fully understand the contextual factors influencing teens' engagement in risk-taking behaviors.

## Sex Differences

Another important factor to consider in relation to risk-taking behaviors is biological sex. Sex differences in the association between popularity and risk-taking have been noted in the literature, as specific types of risk-taking may be more common among boys versus girls, or vice versa. For example, a finding for males only showed that high levels of peer-perceived popularity predicted high levels of marijuana use (past month) and number of sexual partners, while average levels of popularity predicted more cigarette use. In the same study, high popularity was associated with lower cigarette use for females, though no other significant effects for females were found (Prinstein et al., 2011). Further, a "popular" group of high school students (mostly female) showed low endorsement of substance use in general, but above average alcohol use/drunkenness (LaGreca et al., 2001). The reverse association of risk-taking predicting popularity has also been examined, showing that for males, but not females, risk-taking might provide greater social rewards and increase popularity (Rebellon et al., 2018). More work is needed to disentangle the nature of these group differences.

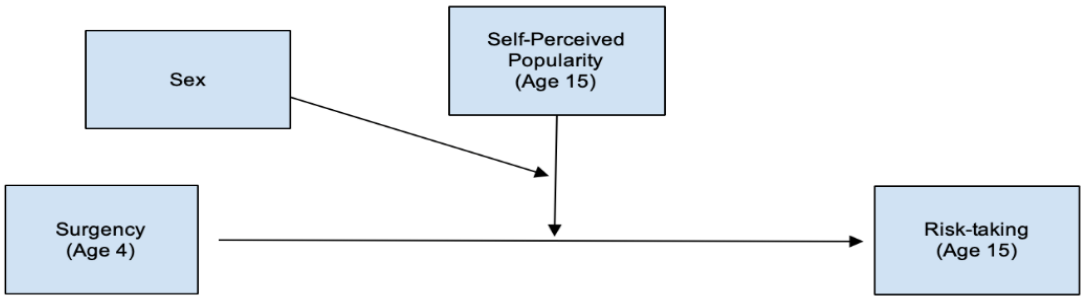
Moreover, some studies have shown mean-level differences in surgency, such that males may have a slightly higher mean rating of surgency in childhood, compared to females (Else-Quest et al., 2006; Putnam et al., 2024). However, research regarding how surgency differentially predicts outcomes for males and females is sparse. Else-Quest (2012) suggests that examining sex as a moderator would provide needed insight into not only mean-level temperament differences, but how sex differences affect the association between temperament and developmental outcomes. It is therefore important to consider the role of sex differences in the association between surgency, self-perceived popularity, and risk-taking to better inform this literature.

# CHAPTER II: THE CURRENT STUDY

The current study examined the individual factor of childhood surgency and contextual factor of adolescent self-perceived popularity as they relate to the engagement in risk-taking behaviors, specifically substance use and sexual intercourse, in adolescent males and females. It was proposed that children who are high in temperamental surgency and view themselves as popular among peers in adolescence, would be more likely to engage in risk-taking behaviors, with an exacerbation of this association for males.

In order to examine the hypothesis that the interaction between surgency, self-perceived popularity, and sex relates to risk-taking outcomes in adolescence, the current study used a three-way interaction model. Regarding main effects, it was hypothesized high levels of surgency would be related to a risk-taking composite of substance use and sexual risk. It was hypothesized that high levels of self-perceived popularity would be related to the composite risk-taking variable. It was also hypothesized that there would be a main effect of sex, such that males show increased risk-taking. Regarding two-way interactions, it was hypothesized that high levels of childhood surgency moderated by high self-perceived popularity would show an increased association with the risk-taking composite. For the second two-way interaction, it was hypothesized that males with high self-perceived popularity would show increased risk-taking for males, compared to females. Regarding the three-way interaction, it was hypothesized that the interaction between high surgency and high self-perceived popularity would show a greater increase in risk-taking for males, compared to females. Given the literature on friends' risk-taking and individual risk-taking, friends' risk-taking was considered as a covariate in the model. The hypothesized model is shown in Figure 1.

**Figure 1. Hypothesized Model**




*Note.* Hypothesized three-way interaction model. Surgency x Self-Perceived Popularity x Sex -> Risk-taking (Composite of alcohol use, cigarettes/tobacco use, marijuana use, and sexual intercourse in past year). *Friends' risk-taking is included as a covariate.

# CHAPTER III: METHODS

## Participants

The current study utilized data from three cohorts of children who are part of an ongoing longitudinal study of social and emotional development. The goal for recruitment was to obtain a sample of children who were at risk for developing future externalizing behavior problems, and who were representative of the surrounding community in terms of race and socioeconomic status (SES). All cohorts were recruited through child day care centers, the County Health Department, and the local Women, Infants, and Children (WIC) program. Potential participants for cohorts 1 and 2 were recruited at 2-years of age (cohort 1: 1994-1996 and cohort 2: 2000-2001) and screened using the Child Behavior Checklist (CBCL 2-3; Achenbach, 1992), completed by the mother, in order to over-sample for externalizing behavior problems. Children were identified as being at risk for future externalizing behaviors if they received an externalizing T-score of 60 or above. Efforts were made to obtain approximately equal numbers of males and females. This recruitment effort resulted in a total of 307 children. Cohort 3 was initially recruited when infants were 6 months of age (in 1998) for their level of frustration, based on laboratory observation and parent report, and were followed through the toddler period (see Calkins, Dedmon, Gill, Lomax, & Johnson, 2002, for more information). Children from Cohort 3 whose mothers completed the CBCL at two-years of age ($N$ = 140) were then included in the larger study. Of the entire sample ($N$ = 447), 37% of children were identified as being at risk for future externalizing problems. There were no significant demographic differences between cohorts with regard to gender, $\chi^2(2, N = 447) = .63$, p = .73, race, $\chi^2(2, N = 447) = 1.13$, p = .57, or two-year SES, $F$ (2, 444) = .53, $p$ = .59.

Of the 447 originally selected participants, six were dropped because they did not participate in any data collection at 2 years old. An additional 12 families participated at recruitment, did not participate at age 2, but did participate at later years. At age 4, 399 families participated. Families lost to attrition included those who could not be located, moved out of the area, declined participation, or did not respond to phone and letter requests to participate. There were no significant differences between families who did and did not participate at age four in terms of gender, $\chi^2$ (1, $N$ = 447) = 3.27, $p$ = .07, race, $\chi^2$ (1, $N$ = 447) = .65, $p$ = .42, 2-year SES, $t$ (432) = -.92, $p$ = .36, or 2-year externalizing $T$ score, $t$ (445) = .45, $p$ = .65. There were no significant differences between families who did and did not participate in the 15-year assessment in terms of race, $\chi^2$ (3, $N$ = 447) = 3.96, $p$ = .27, 2-year SES $t$ (432) = −0.56, $p$ = .58, or 2-year externalizing $T$-score, $t$ (445) = 0.24, $p$ = .81. Boys were less likely to participate in the 15-year- assessment, $\chi^2$ (1, $N$ = 447) = 9.31, $p$ = .002.

In the current sample, data were examined, and any variable with only ID and/or sex data were deleted. The current study includes a sample size of 271 children (125 males, 146 females) who participated at the 4 and 15-year assessments. In this sample, Cohort 1 was deleted from the analyses because self-perceived popularity data were not collected at age 15. Missing data for individual variables was handled in the analysis using the Maximum Likelihood estimator in order to use the full sample. The sample was 69.0% European American, 24.7% African American, 4.1% Mixed Race, and 2.2% other. Families were economically diverse based on the Hollingshead (1975) Four Factor Index with scores ranging from 14.00 to 66.00 ($M$ = 39.64, $SD$ = 10.82), thus representing families from each level of social strata typically captured by this scale. Hollingshead scores that range from 40 to 54 reflect minor professional and technical occupations considered to be representative of middle class.

## Procedures

IRB approval was granted for this study. Consent was acquired from parents when children were less than 4 years of age. At age 15, both parental consent and child assent were granted. When children were 4 years old, mothers came into the lab to complete a packet of measures. At this visit, mothers completed an established temperament measure (CBQ-LF). When the participants were 15 years old, they reported on their own self-perceived popularity during a laboratory visit. At the 15-year lab visit, adolescents also self-reported on their engagement in risky behaviors and their friends' risky behaviors. Participants received monetary compensation of $50 for participation in the laboratory visit.

## Measures

***Temperament.*** The Child Behavior Questionnaire-Long Form (CBQ-LF; Rothbart, Ahadi, Hershey, & Fisher, 2001) is a 195-item questionnaire on which mothers rate their child's behavior on a 7-point likert scale ranging from 1 = *extremely untrue* to 7 = *extremely true.* There is also an "*NA*" option handled as a score of 0 and included in the score calculation. The original factor analysis of these items yielded three broad dimensions of temperament, which are widely used in the literature. The scales have been validated and show adequate reliability. The validity was shown through high parental agreement in responses and the prediction of social and laboratory behavior patterns (Rothbart et al., 2001). The broad temperament dimension of Surgency/Extraversion ($M$ = 4.83, $SD$ = 0.66) was used in this study. The score for the Surgency/Extraversion dimension was found by taking the average of the High-Activity Level, High-Intensity Pleasure, Impulsivity, and Shyness (reverse-coded) subscales. In our sample, these items showed adequate internal consistency ($\alpha$ = .76). Some examples of the items from the Surgency/Extraversion measure include "Usually rushes into an activity without thinking about

it", “Decides what s/he wants very quickly and goes after it “, and “Joins others quickly, even when they are strangers”.

***Self-perceived Popularity.*** At 15 years of age, participants self-reported ratings on the “What My Peers Think About Me” questionnaire (e.g. Holmes et al., 2015). The full questionnaire consists of 10 items measuring the participants’ perceptions of their standing among peers on a scale ranging from 1 = *Almost No One* to 5 = *Almost Everyone*. A single item asking, *“How many people in your grade think that you are popular?”* was used to measure self-perceived popularity (*M* = 3.09, *SD* = 1.17).

***Risk-taking Behaviors.*** Risk-taking was defined as behaviors that have the potential to lead to harmful outcomes and focused on substance use and sexual risk. Adolescents self-reported on their substance use and risky sexual behavior using items from the Risky Behavior Protocol (adapted from multiple risk-taking self-report questionnaires i.e., Conger & Elder, 1994; Halpern-Felsher et al., 2004). This questionnaire consists of two similarly constructed measures and were renamed for the study as, “Things I Do” and “Things My Friends Do”. The “Things I Do” scale was used to assesses the adolescent’s engagement in substance use and sexual intercourse. The full measure consists of 27 questions which include minor risky behaviors (e.g., “*smoked cigarettes or used tobacco*”) and major risky behaviors (e.g., “*been a gang member or gang affiliated*”), however, only four items related to substance use and sexual behavior were used in this study, discussed below.

*Substance use* included single items related to cigarette use, alcohol use, and marijuana use. For cigarette use (*M* = 0.19, *SD* = 0.53), participants responded to the item, “*How many times in the past year have you…smoked cigarettes or used tobacco?*”. Responses were scored on a scale from 0 to 2, including “Not at all”, “Once or twice”, and “More than twice”. For

alcohol use (*M* = 0.35, *SD* = 0.63), participants responded to the item, "*How many times in the past year have you…drunk a bottle or glass of beer or other alcohol?*". Responses were scored on a scale from 0 to 2, including "Not at all", "Once or twice", and "More than twice". For marijuana use (*M* = 0.26, *SD* = 0.60), participants responded to the item, "*How many times in the past year have you…used or smoked marijuana (pot, grass, weed)?*". Responses were scored on a scale from 0 to 2, including "Not at all", "Once or twice", and "More than twice".

*Risky sexual behavior* (*M* = 0.19, *SD* = 0.54) was also measured using an item from the Risky Behavior Protocol. Participants responded to "*How many times in the past year have you…had sexual intercourse (going all the way)?*". Responses were scored on a scale from 0 to 2, including "Not at all", "Once or twice", and "More than twice".

*Friends' Risk-taking behavior* (*M* = 2.71, *SD* = 2.34) was computed as a composite score based on the same items (alcohol use, cigarette/tobacco use, marijuana use, and sexual intercourse) used for the individual risk-taking variables ($\alpha$ = .88). Items from the "Things My Friends Do" questionnaire (described above) were used for this variable. For example, participants responded to "*How many of the friends you hang out with have ever…smoked cigarettes or used tobacco?*". Responses were scored on a scale from 0 to 2, including "None of them", "One or a few of them", and "Almost all of them".

While using single items to assess constructs could cause concern related to construct validity and predictive power, it may also help to maintain the purity of the construct and not confound it with other related constructs (Strauss & Smith, 2009). Correlations among risk-taking behaviors will be examined to determine if and how risk-taking behaviors are combined into a composite variable.

## Data Analytic Plan

Descriptive statistics, including means, standard deviations, skew, and kurtosis for all variables are reported in Table 1. Correlations between all variables are reported in Table 2. A multiple regression analysis was conducted with a composite of risk-taking, including alcohol use, marijuana use, cigarette use, and sexual intercourse, as the dependent variable. Surgency and self-perceived popularity were centered before being entered into the model. Sex was dummy coded as 1 for males, and 0 for females (reference group). Standardized beta coefficients were used. The model included all main effects of surgency, self-perceived popularity, and sex on risk-taking. All two-way interactions, including surgency and self-perceived popularity, self-perceived popularity and sex, and sex and surgency were also included. Finally, the three-way interaction of surgency, self-perceived popularity, and sex was included. A composite variable of friends' risk-taking was included as a covariate in the model and entered as a predictor. Predictor terms were all entered simultaneously. Results were compared before and after the covariate was entered into the model in order to understand its unique contribution and control for its effects, to provide a more accurate estimation of the predictors and interactions of interest in this study. The probing of significant interactions uses simple slopes based on procedures outlined by Aiken and West (1991).

### Preliminary Analyses

The skew and kurtosis of all variables were considered within an acceptable range (see Table 1 below), using a boundary of +/- 3 for skew, and +/- 7 for kurtosis. It is not uncommon for risk variables to be positively skewed when examining these behaviors in a community sample, and this will be considered in the interpretation of the results. Considering sample correlations (see Table 2 below), all correlations were in the expected directions. Also as

expected, items related to specific substance use and sexual risk-taking behaviors were highly correlated. Based on the high correlations among risk-taking variables, scores on individual risk-taking behaviors were added together to create a composite risk-taking score *(M* = 0.98, *SD* = 1.89*)* ranging from 0 to 8, where 0 = *No risk-taking in the past year* and 8 = *Engaging in all four behaviors more than twice in the past year*. In this sample, these items showed adequate internal consistency ($\alpha$ = .84). Consistent with the literature, friends' risk-taking was highly correlated with individual risk-taking and, therefore, included as a covariate in the model.

**Table 1.** ***Descriptive Statistics for Main Variables for Full Sample (N=271)***

| Variable | *M* | *SD* | Min | Max | Skew | Kurtosis |
|---|---|---|---|---|---|---|
| 1.Surgency | 4.83 | 0.66 | 2.77 | 6.73 | 0.73 | 0.53 |
| 2.Popularity | 3.09 | 1.17 | 1.00 | 5.00 | -0.34 | -0.73 |
| 3. Cig_15 | 0.19 | 0.53 | 0.00 | 2.00 | 2.74 | 6.26 |
| 4. Alc_15 | 0.35 | 0.63 | 0.00 | 2.00 | 1.61 | 1.37 |
| 5. Mar_15 | 0.26 | 0.60 | 0.00 | 2.00 | 2.21 | 3.42 |
| 6. Sex_15 | 0.19 | 0.54 | 0.00 | 2.00 | 2.70 | 5.96 |
| 7. Risk_15 | 0.98 | 1.89 | 0.00 | 8.00 | 2.29 | 4.58 |
| 8.FrRisk_15 | 2.71 | 2.34 | 0.00 | 8.00 | 0.46 | -0.62 |

**Table 2.** ***Correlations of Main Variables for Full Sample (N=271)***

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Surgency | | | | | | | |
| 2. Popularity | 0.064 | | | | | | |
| 3. Cig_15 | **0.181*** | 0.072 | | | | | |
| 4. Alc_15 | **0.158*** | 0.120 | **0.734**** | | | | |
| 5. Mar_15 | 0.123 | 0.057 | **0.670**** | **0.659**** | | | |
| 6. Sex_15 | **0.152*** | 0.137 | **0.503**** | **0.453**** | **0.430**** | | |
| 7. Risk_15 | **0.184*** | 0.115 | **0.875**** | **0.872**** | **0.843**** | **0.730**** | |
| 8. FRisk_15 | 0.140 | 0.113 | **0.440**** | **0.565**** | **0.559**** | **0.390**** | **0.597**** |

*Note.* * indicates $p < .05$. ** indicates $p < .01$.

**Sex Differences**

T-tests were conducted in SPSS to examine mean differences by sex within the main study variables. Results showed significant sex differences in surgency ($p < .001$), with males showing a higher average score. The t-test for the composite risk-taking variable showed results that were approaching significance ($p= 0.061$). Additionally, the item related to marijuana use also showed significant mean differences by sex ($p = 0.010$), with males showing a higher average score. Descriptive statistics by sex are displayed in Table 3 and 4. Descriptive statistics for females showed high kurtoses for all risk-taking variables, except for alcohol use, which shows that for these variables, females displayed high values outside of a normal distribution. Correlations by sex are displayed in Table 5. Correlations showed different patterns for males and females, such that surgency was significantly correlated with cigarette use, sexual activity,

and the risk-taking composite for females, and not males. Based on preliminary analyses, the model was run as proposed.

**Table 3.** ***Descriptives for Main Study Variables for Males***

| Variable | N | *M* | *SD* | Min | Max | Skew | Kurtosis |
|---|---|---|---|---|---|---|---|
| 1. Surgency | 125 | 4.98 | 0.67 | 3.46 | 6.46 | 0.18 | -0.73 |
| 2. Popularity | 125 | 3.15 | 1.15 | 1.00 | 5.00 | -0.40 | -0.72 |
| 3. Cig_15 | 125 | 0.24 | 0.57 | 0.00 | 2.00 | 2.35 | 4.30 |
| 4. Alc_15 | 125 | 0.41 | 0.68 | 0.00 | 2.00 | 1.39 | 0.59 |
| 5. Mar_15 | 125 | 0.39 | 0.73 | 0.00 | 2.00 | 1.55 | 0.76 |
| 6. Sex_15 | 125 | 0.25 | 0.58 | 0.00 | 2.00 | 2.25 | 3.87 |
| 7. Risk_15 | 125 | 1.28 | 2.07 | 0.00 | 8.00 | 1.84 | 2.66 |
| 8. FrRisk_15 | 125 | 2.95 | 2.37 | 0.00 | 8.00 | 0.33 | -0.68 |

**Table 4.** ***Descriptives for Main Study Variables for Females***

| Variable | N | *M* | *SD* | Min | Max | Skew | Kurtosis |
|---|---|---|---|---|---|---|---|
| 1. Surgency | 146 | 4.71 | 0.63 | 2.77 | 6.73 | 0.07 | 0.94 |
| 2. Popularity | 146 | 3.05 | 1.19 | 1.00 | 5.00 | -0.30 | -0.71 |
| 3. Cig_15 | 146 | 0.15 | 0.49 | 0.00 | 2.00 | 3.19 | 8.99 |
| 4. Alc_15 | 146 | 0.30 | 0.58 | 0.00 | 2.00 | 1.83 | 2.30 |
| 5. Mar_15 | 146 | 0.15 | 0.47 | 0.00 | 2.00 | 3.14 | 8.91 |
| 6. Sex_15 | 146 | 0.15 | 0.51 | 0.00 | 2.00 | 3.22 | 8.88 |
| 7. Risk_15 | 146 | 0.76 | 1.73 | 0.00 | 8.00 | 2.83 | 7.59 |
| 8. FrRisk_15 | 146 | 2.53 | 2.31 | 0.00 | 8.00 | 0.58 | -0.49 |

**Table 5.** ***Correlations of Main Variables for Males (Upper) and Females (Lower)***

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1.Surgency | | 0.156 | 0.070 | 0.124 | 0.088 | -0.049 | 0.076 | 0.148 |
| 2.Popularity | -0.002 | | 0.101 | 0.086 | -0.003 | 0.079 | 0.077 | 0.072 |
| 3.Cig_15 | **0.259**** | 0.043 | | **0.763**** | **0.727**** | **0.329**** | **0.872**** | **0.475**** |
| 4. Alc_15 | 0.156 | 0.148 | **0.700**** | | **0.640**** | **0.377**** | **0.867**** | **0.583**** |
| 5. Mar_15 | 0.089 | 0.126 | **0.607**** | **0.695**** | | **0.366**** | **0.863**** | **0.599**** |
| 6. Sex_15 | **0.299**** | 0.184 | **0.672**** | **0.521**** | **0.509**** | | **0.621**** | **0.340**** |
| 7. Risk_15 | **0.240*** | 0.146 | **0.879**** | **0.875**** | **0.826**** | **0.796**** | | **0.627**** |
| 8. FRisk_15 | 0.104 | 0.141 | **0.401**** | **0.544**** | **0.526**** | **0.425**** | **0.564**** | |

*Note.* * indicates $p < .05$. ** indicates $p < .01$.

# CHAPTER IV: RESULTS

## Missing data

In Mplus (Verson 8; Muthén & Muthén, 2017), Maximum Likelihood with Robust Standard Errors (MLR) was used as the estimator to account for missing data on questionnaire measures for participants who had data collected from at least one timepoint to increase the sample size and, subsequently, power. MLR was used since it is robust to non-normality in the dependent variable.

## Main Effects

Results are shown in Table 6 below. Regarding main effects, the regression model showed a positive association, approaching significance, between surgency and risk-taking ($b$ = 0.196 [0.024, 0.368], $SE$ = 0.105, $p$ = .061). The main effect between surgency and risk-taking was significant ($b$ = 0.278 [0.126, 0.430], $SE$ = 0.092, $p$ = .003), before the covariate of friends' risk-taking was entered into the model. No significant associations between self-perceived popularity and risk-taking, or sex (male) and risk-taking were noted.

## Two-Way Interactions

The two-way interaction between surgency and self-perceived popularity showed a significant, positive association ($b$ = 0.168 [0.029, 0.307], $SE$ = 0.085, $p$ = .047). The two-way interactions between surgency and sex (male), as well as self-perceived popularity and sex (male), did not show significant associations. These results did not differ in significance without the covariate included in the model.

## Three-Way Interaction

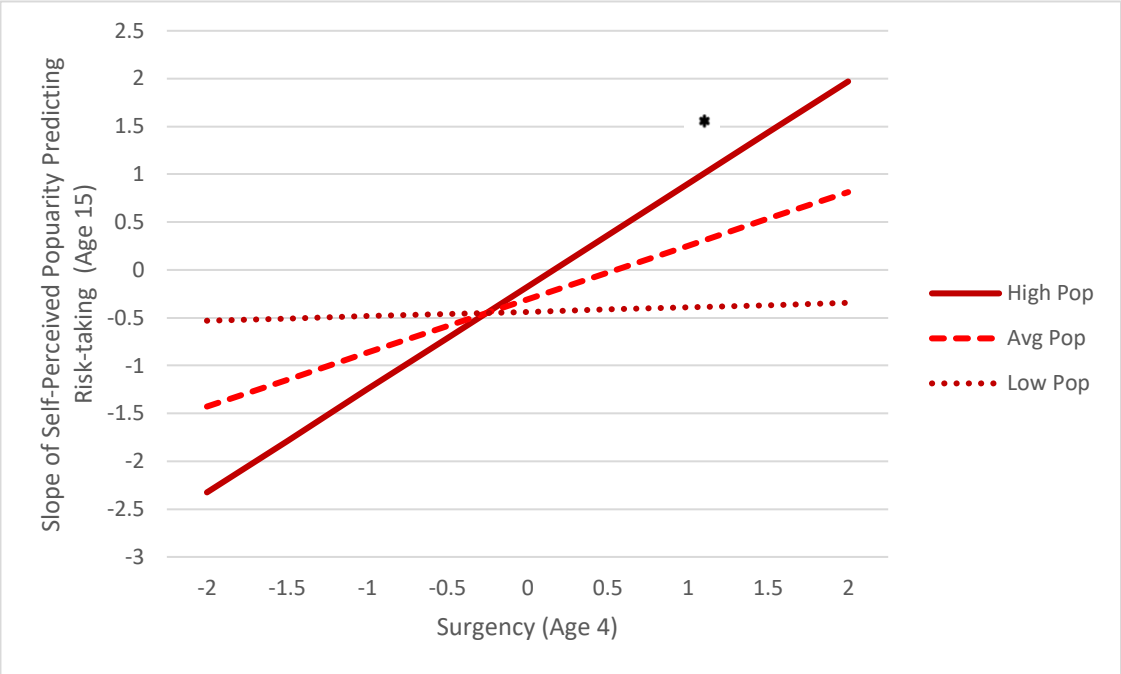
The three-way interaction between surgency, self-perceived popularity, and sex (male) showed a significant, negative association (*b* = -0.209 [-0.374, -0.043], *SE* = 0.101, *p* = .038). These results did not differ in significance without the covariate included in the model. Due to the significant three-way interaction, the significant two-way interaction was not interpreted. The significant three-way interaction was probed using simple slopes (Aiken and West, 1991). Specifically, for males and females separately, an examination of how the relation of the predicator variable to the criterion variable varied depending on the moderator variable was undertaken. The relation of the predictor to the criterion was examined at 3 points for the moderator, -1 standard deviation below the mean, mean, and +1 standard deviation above the mean. Probing showed significance only for females, such that high levels of surgency showed increased risk-taking in the context of high levels of self-perceived popularity (*b* = 1.074 [0.207, 1.941], *SE* = 0.527, *p* = .042), shown in Figure 2 below.

**Table 6.** ***Standardized Model Estimates, Standard Errors, and P-values***

| Predictor | *b* | SE | *p* |
|---|---|---|---|
| Surgency | 0.196 | 0.105 | 0.061 |
| Popularity | 0.069 | 0.077 | 0.371 |
| Sex (male) | 0.082 | 0.062 | 0.189 |
| Friend Risk | 0.556** | 0.059 | 0.000 |
| Sur x Pop | 0.168* | 0.085 | 0.047 |
| Surg x Sex (male) | -0.138 | 0.111 | 0.214 |
| Pop x Sex (male) | 0.002 | 0.084 | 0.985 |
| Surg x Pop x Sex (male) | -0.209* | 0.101 | 0.038 |

*Note.* * indicates $p < .05$. ** indicates $p < .01$. $R^2 = 0.402$. $R^2 = 0.109$ (without covariate).

**Figure 2. Slope of Increasing Risk-Taking as Surgency and Self-Perceived Popularity Increase for Females**




## Post Hoc Analyses

Based on the significant three-way interaction, exploratory follow-up analyses were conducted to examine three-way interactions for the four risk-taking behaviors separately (alcohol use, cigarette/tobacco use, marijuana use, and sexual intercourse). These analyses were conducted in order to better understand how surgency, self-perceived popularity, and sex interact to predict each of these risky behaviors separately and explore whether the results follow the same patterns for each behavior. For each individual risk-taking behavior, friends' engagement in that specific risk-taking behavior was included as a covariate. Bonferroni correction was used to adjust the alpha level from 0.05 to 0.0125 to account for the four risk-taking variables being compared. Results are shown in tables 7, 8, 9, and 10.

Results (Table 7) showed that for cigarette use, there was a significant, positive main effect of surgency predicting cigarette use ($p = 0.005$). There was also a significant two-way interaction between surgency and self-perceived popularity predicting cigarette use ($p = 0.003$). Probing the significant two-way interaction showed significance at average ($p = 0.008$) and high ($p = 0.005$) levels of self-perceived popularity. This shows that both males and females who are reported as high on surgency and view themselves as having average and high levels of popularity, engage in increased cigarette use.

**Table 7.** ***Standardized Model Estimates, Standard Errors, and P-values for Cigarette Use***

| **Predictor** | ***b*** | **SE** | ***p*** |
|---|---|---|---|
| Surgency | 0.273* | 0.098 | 0.005 |
| Popularity | 0.042 | 0.095 | 0.655 |
| Sex (male) | 0.049 | 0.076 | 0.514 |
| Friend Cig Use | 0.230* | 0.063 | 0.000 |
| Sur x Pop | 0.230* | 0.076 | 0.003 |
| Surg x Sex (male) | -0.130 | 0.134 | 0.330 |
| Pop x Sex (male) | 0.031 | 0.108 | 0.776 |
| Surg x Pop x Sex (male) | -0.281 | 0.125 | 0.024 |

*Note.* * indicates $p < .0125$. $R^2 = 0.162$. $R^2 = 0.098$ (without covariate).

Results (Table 8) showed that for alcohol use, there was a significant two-way interaction between surgency and self-perceived popularity predicting alcohol use ($p = 0.008$). There was also a significant three-way interaction between surgency, self-perceived popularity, and sex (male) predicting alcohol use ($p = 0.009$). Probing the significant three-way interaction showed significance for females at high levels of self-perceived popularity ($p = 0.012$).

**Table 8.** ***Standardized Model Estimates, Standard Errors, and P-values for Alcohol Use***

| Predictor | *b* | SE | *p* |
|---|---|---|---|
| Surgency | 0.212 | 0.094 | 0.023 |
| Popularity | 0.097 | 0.081 | 0.231 |
| Sex (male) | 0.064 | 0.068 | 0.344 |
| Friend Alc Use | 0.429* | 0.055 | 0.000 |
| Sur x Pop | 0.208* | 0.079 | 0.008 |
| Surg x Sex (male) | -0.075 | 0.114 | 0.507 |
| Pop x Sex (male) | -0.033 | 0.092 | 0.721 |
| Surg x Pop x Sex (male) | -0.262* | 0.101 | 0.009 |

*Note.* * indicates $p < .0125$. $R^2 = 0.273$. $R^2 = 0.079$ (without covariate).

Results (Table 9) showed that for marijuana use, there was only a significant main effect for sex (male) predicting marijuana use ($p = 0.008$).

**Table 9.** ***Standardized Model Estimates, Standard Errors, and P-values for Marijuana Use***

| Predictor | *b* | SE | *p* |
|---|---|---|---|
| Surgency | 0.038 | 0.060 | 0.520 |
| Popularity | 0.026 | 0.080 | 0.742 |
| Sex (male) | 0.168* | 0.064 | 0.008 |
| Friend Mar Use | 0.453* | 0.067 | 0.000 |
| Sur x Pop | 0.008 | 0.058 | 0.893 |
| Surg x Sex (male) | 0.004 | 0.113 | 0.970 |
| Pop x Sex (male) | -0.004 | 0.112 | 0.969 |
| Surg x Pop x Sex (male) | -0.120 | 0.131 | 0.360 |

*Note.* * indicates $p < .0125$. $R^2 = 0.282$. $R^2 = 0.076$ (without covariate).

Results (Table 10) showed that for sexual activity, there was a significant, positive main effect of surgency on sexual activity ($p = 0.008$). There was a significant, positive two-way interaction between surgency and self-perceived popularity on sexual activity ($p = 0.002$). Probing this significant two-way interaction showed significance at high levels of self-perceived popularity ($p = 0.006$), such that males and females who are reported as high on surgency and view themselves as highly popular engage in increased sexual activity. There was also a significant, negative two-way interaction between surgency and sex (male) on sexual activity ($p = 0.008$), showing a significant difference for males, compared to females. Probing this significant two-way interaction showed approaching significance only for females ($p = 0.014$), such that females who are reported as high on surgency engage in increased sexual activity. The association for males was negative, though non-significant.

**Table 10.** ***Standardized Model Estimates, Standard Errors, and P-values for Sexual Activity***

| **Predictor** | ***b*** | **SE** | ***p*** |
|---|---|---|---|
| Surgency | 0.304* | 0.115 | 0.008 |
| Popularity | 0.167 | 0.079 | 0.034 |
| Sex (male) | 0.050 | 0.067 | 0.455 |
| Friend Sex | 0.344* | 0.064 | 0.000 |
| Sur x Pop | 0.271* | 0.089 | 0.002 |
| Surg x Sex (male) | -0.293* | 0.111 | 0.008 |
| Pop x Sex (male) | -0.026 | 0.095 | 0.785 |
| Surg x Pop x Sex (male) | -0.235 | 0.095 | 0.014 |

*Note.* * indicates $p < .0125$. $R^2 = 0.244$. $R^2 = 0.114$ (without covariate)

# CHAPTER V: DISCUSSION

The temperament literature has largely shown a positive association between temperamental surgency and risk-taking outcomes (e.g. Youssef et al., 2016; Cooper et al., 2001; Honomichl & Donnellan, 2012). Further, the peer influence literature has linked adolescent popularity to risk-taking behaviors, suggesting that adapting to behaviors of valued peers provides both extrinsic social and emotional rewards, as well as intrinsic rewards related to a favorable sense of self (Brechwald & Prinstein, 2011). Therefore, considering previous work, evidence suggests that surgency and popularity both may be related to risk-taking. Previous studies, however, have not examined how these factors interact to predict risk-taking behaviors in adolescence, considering sex differences.

Thus, the goal of the present study was to examine childhood surgency and adolescent self-perceived popularity as they relate to the engagement in risk-taking behaviors, specifically substance use (alcohol, cigarettes, and marijuana) and sexual intercourse, in adolescent males and females. First, it was hypothesized that there would be a main effect for surgency on risk-taking behaviors. Despite the substantial evidence from previous work, it was surprising that the main effect between surgency and risk-taking was not significant, though it approached significance in the expected direction. Specifically, the significant association between surgency and risk-taking was attenuated when friends' risk-taking was added into the model, suggesting that this may be a more robust predictor of individual adolescent risk-taking. This is the only significant association that became non-significant by the inclusion of the covariate. Although friends' risk-taking was considered a covariate and not a main variable of interest in this study, given the highly positive and significant association with individual risk-taking across models, as

well as the large amount of explained variance across models, this is undoubtedly an important construct to continue to study in considering adolescent risk-taking.

Next, it was hypothesized that there would be a main effect between self-perceived popularity and risk-taking. Interestingly, there was no association between self-perceived popularity and risk-taking in this study. Despite substantial evidence for the association between popularity and risk-taking in the literature, this study examines self-perceived popularity, rather than peer-perceived popularity. It is possible that the item used to measure self-perceived popularity in this study is measuring a different, although markedly important, construct that could have implications for the results. One hypothesis is that it could be that teens' who perceived themselves as being popular have higher self-esteem. A recent study examining adolescent conformity to high status peers found that the individual's alignment with popular peers was related to increases in self-esteem for males, but not females (Field et al., 2023). More work is needed to continue to understand the link between teens' perceptions of their own popularity and other identity-based factors, such as likeability, self-esteem, and acceptance, and how these variables relate to risk-taking, considering sex differences in this association.

Further, it was hypothesized that there would be a significant two-way interaction between self-perceived popularity and sex, such that males with high levels of popularity would show increased risk-taking, though this interaction was not significant. Relatedly, it was hypothesized that the three-way interaction between high surgency, high self-perceived popularity, and sex would show a greater increase in risk-taking for males, compared to females. While support for the three-way interaction was found, surprisingly, this was only true for females, not males. These results suggest that for females who show high levels of surgency (i.e. high activity level, high intensity pleasure, high impulsivity, and low shyness) in childhood, and

view themselves as popular in adolescence, are more likely to engage in increased risk-taking at this time. In contrast to the findings for females, males showed a negative, although non-significant, interaction between high surgency, high self-perceived popularity, and risk-taking. Many studies have shown the increased importance of social relationships for females over males, as females care more about evaluating social interactions and avoiding social exclusion (e.g. Arch, 1993). Females also tend to be more sensitive to the status of their peer relationships and friendships (Rose & Rudolph, 2006). For females high in surgency, this subsequent self-perceived popularity in adolescence may lead to social decisions that perpetuate their popularity status. Perhaps for males, who do not typically share these tendencies, the interaction of high surgency and high self-perceived popularity is related to more adaptive outcomes, such as increased physical activity or participation in sports teams (e.g. Janssen et al., 2017). When considering the significant slope for females, it is also important to note that females who see themselves as highly popular, but are low in childhood surgency, engage in the least amount of risk-taking. In the literature, low surgency has been linked to behavioral wariness (Dollar & Stifter, 2012) and higher levels of shyness (Kagan, 1999). Perhaps these females who view themselves as highly popular but are low in surgency do not enjoy the social context where adolescent risk-taking likely occurs, such as parties. Instead, perhaps these female adolescents belong to more adaptive peer groups (e.g. sports teams). This highlights the likelihood that the self-perception of high popularity may be interpreted differently and lead to different behaviors (i.e. engagement in risk-taking) for females who are rated at the lower level of surgency compared to higher levels. This finding may confirm the benefit of prevention and intervention efforts focused on teaching self-regulation skills to children who display high surgency in early childhood. However, it may also be important to examine at what level low surgency may be

impairing, as it has been linked with lower social competence (Fox et al., 1995) and internalizing symptoms (Oldehinkel et al., 2004) in some cases as well. Varying levels of surgency have been related to both adaptive and maladaptive outcomes, and it is therefore necessary to continue to examine other moderating variables that affect these outcomes. These results may also highlight the lower acceptability of behaviors that are characteristic of surgency (e.g. high activity level, high approach) in females compared to males, which may in turn lead to behaviors that are believed to help the adolescent "fit in", such as risk-taking. These findings highlight the importance of considering different developmental and socialization processes in males and females, especially in adolescence.

Interestingly, post-hoc analyses examining individual risk-taking variables (i.e. alcohol use, cigarette/tobacco use, marijuana use, and sexual intercourse), rather than the composite risk-taking variable, showed similar patterns, with a few exceptions. First, alcohol use showed the same pattern of results to the main study, such that highly surgent females at high levels of self-perceived popularity engaged in increased alcohol use. It is possible that alcohol use is more socially acceptable, and even "cool", for females, compared to the other risk-taking variables in this study. This is not surprising given previous work that found a "popular" group of high school students (mostly female) showed low endorsement of substance use in general, but above average alcohol use/drunkenness (LaGreca et al., 2001).

Next, marijuana use only showed a significant main effect for sex, such that being male is associated with increased marijuana use. It may be that marijuana use does not offer the same social reward and status for highly surgent females that the other risk-taking behaviors in this study do. It is possible that marijuana use is more appealing to a different subset of individuals, specifically males, and potentially those with different temperamental dispositions.

The post-hoc analyses also revealed 2 two-way interactions for the sexual activity outcome variable. First, the interaction between surgency and high self-perceived popularity predicted increased sexual activity for both males and females. While previous research has shown high peer-perceived popularity to predict increased sexual activity only for males (e.g. Prinstein et al., 2011), this specific interaction with surgency has not been previously studied. It is also possible that there are discrepancies between the self-perceived and peer-perceive popularity ratings, though that is beyond the scope of this study. In addition, there was a unique two-way interaction between surgency and sex in predicting sexual activity. Specifically, there was a significant difference in how surgency alone predicted sexual activity for males and females. Although the slopes did not reach significance, the association between surgency and sexual activity was positive for females, and the association was negative for males. As described above, it may be that, for males, surgency is related to more adaptive and less risky outcomes (e.g. Janssen et al., 2017).

In examining cigarette use as an outcome variable, the two-way interaction between surgency and self-perceived popularity, suggests that highly surgent males and females at both average and high levels of self-perceived popularity engage in increased cigarette use. This was surprising, as results from a previous study showed that males at average levels of peer-perceived popularity engaged in increase cigarette use, whereas only females at very low levels of popularity engaged in increased cigarette use (e.g. Prinstein et al., 2011). As described above, it is possible that there are discrepancies in the self-perceived and peer-perceive popularity associated with this behavior. It is also worth noting that this sample is from central North Carolina where tobacco has economic importance, and its use is socialized in a more acceptable way than it might be in other places. In considering cigarette use in this sample, it is also

important to note that the 15-year data was collected 10 years ago and trends in cigarette use among adolescents has changed in recent years. However, despite a decrease in cigarette use over the past decade, e-cigarettes have become popular among teens, showing an even greater prevalence than traditional cigarette use, making this an important behavior to continue studying (Kann et al., 2018).

## Strengths

This study has several strengths. First, this study uses longitudinal data spanning 11 years to understand the link between surgency, self-perceived popularity, risk-taking, considering sex differences. This design helps to inform the developmental literature on early childhood surgency and how it relates to adolescent risk-taking. The longitudinal design allows us to understand multiple age points for prevention and intervention efforts. For example, it may be important to consider prevention, such as self-regulation tools, for females displaying high levels of surgency in childhood. Yet, it is also important to consider how, for highly surgent females, adolescence is a heightened period of risk for the engagement in behaviors that could lead to harmful outcomes. Examining age points that span from childhood to adolescence is certainly a strength of this study.

The use of a community sample is another strength of this study. While community samples often display low-level risk-taking, data about this group is necessary to inform universal prevention efforts, such as those in school settings. While the majority of teens in this sample are not engaging in very frequent and high-level risk-taking, understanding risk-taking behaviors in a community sample informs the continual developmental of prevention efforts targeted at the general teen population. Relatedly, examining risk-taking at 15-years-old provides needed information about a critical developmental period when many teens are transitioning to

high school and have access to new peer groups and experiences. Research has also shown that earlier risk-taking is predictive of increased mental health problems and more serious risk-taking behavior, such as substance use disorder, in the future (e.g. McGue and Iacono, 2005; Vasilenko et al., 2016; Jordan & Andersen, 2017).

Additionally, while there is a substantial body of literature on peer-perceived and sociometric popularity and risk-taking behaviors in adolescence, there are few studies that consider self-perceived popularity. However, the construct of self-perceived popularity is arguably even more important, as an individual's thoughts and perceptions, despite their objective accuracy, tend to affect their behaviors (Mayeux & Cillessen, 2008). Given the lack of main effect and low correlations between self-perceived popularity and risk-taking in this sample, it may be that the construct of self-perceived popularity is measuring something different, such as self-esteem, and needs to be uniquely considered in comparison to sociometric, and peer-perceived popularity.

Finally, this study was a necessary contribution to the literature examining how surgency interacts with other variables, considering sex differences. Despite higher mean levels of surgency between males and females in this study and in the literature, little is known about how varying levels of surgency play out in boys and girls as they grow up and interact with the world around them. This was just one study that considered how high levels of childhood surgency and self-perceptions of popularity may have a different effect on risk-taking for males and females. Continued work is needed to better understand these unique socialization processes and should include other moderator variables.

## Limitations

Despite these strengths, several limitations are noted. First, given the use of a community sample, therefore, engagement in risk-taking was low and positively skewed. Thus, results must be considered in the context of minimal risk-taking that may be considered relatively normative at this time in development. Further, although the use of self-perceived popularity was an important contribution to the literature, we do not have data on sociometric, or peer-rated popularity at this age, and therefore cannot determine the objective accuracy of the self-perceptions of popularity and how this might differ for males and females as well. Additionally, this study used self-reports of teens' risk-taking and friends' risk-taking behaviors, which may not always be reported accurately. Also, due to missing self-perceived popularity data for the whole first cohort, the full sample of the larger longitudinal study was not able to be used. The lower sample size may subsequently affect the power of this study. Although the longitudinal design may be seen as a strength of this study, there are many other factors, including parenting behaviors, that influence development from age 4 to 15 that were not taken into account in this study. A recent study has shown that parents' perception of risk-taking is a strong indicator of adolescents' risk-taking behavior (Field & Prinstein, 2023), and may be important to consider, among other factors.

## Future Directions

This study may serve to inform many avenues of future work. One important future direction would be to consider different pathways to risk-taking. The friends' risk-taking variable included as a covariate in this study was strongly associated with teens' risk-taking, which is consistent with previous literature (e.g. Prinstein & Cillessen, 2003; Dishion and Owen 2002; Hawkins et al. 1992). It will be important to consider multiple pathways to risk-taking, such as

through deviant or rejected peers, in the same model to understand the equifinality of risk-taking behaviors in adolescence and the unique peer groups and related mechanisms that contribute to this outcome.

Additionally, some of the work examining the association between surgency and risk-taking has already begun to consider different components of surgency (i.e. high intensity pleasure, approach motivation, etc.), and how some components may be more central in this association. It would be interesting to consider these distinct components in light of this study and consider the sex differences in how these components of surgency interact with other variables to predict risk-taking. Some work has already found components of activity level and approach behavior to be higher in males, while positive mood has been shown to be higher in females (Else-Quest et al., 2006; Consentino-Rocha & Linhares, 2013; Gagne, 2013).

Further, although this study was specific to substance use and sexual risk-taking, future studies should also consider a broader range of risk-taking behaviors, such as unhealthy eating habits, inactivity, stealing, driving over the speed limit, etc. to better understand the bigger picture of risk-taking in adolescence. In this study, marijuana use was the only risk-taking behavior to show a distinctly different pattern of results compared to the study results examining the composite risk-taking variable. It may be that marijuana use does not offer the same social reward and status that the other risk-taking behaviors do. With this in mind, it would be important to further examine risk-taking behaviors individually to better understand their function in the lives of teens. Future studies should also replicate this model in a sample with larger amounts of risk-taking endorsed to continue to understand for whom, and under what circumstances, this interaction is most relevant. Future work may also consider examining these

hypotheses in an older sample, such as in emerging adults, to understand if this is an adolescent-limited finding, or if these patterns exist into the early adult years.

## Conclusion

Overall, the results of this study showed that females who are reported as high on surgency in childhood, and see themselves as being popular in middle adolescence, engage in increased risk-taking behaviors at this same time. This study considered associations over 11 years and is important in understanding the development of risk-taking behaviors in teens. This study has important implications for prevention and intervention efforts, especially for female adolescents who display high temperamental surgency, and in the context of popular peer relationships. This study should be used to consider early interventions for teaching self-regulation skills for children high on surgency in childhood. The findings should also prompt considerations related to the importance of positive peer group affiliations for females in adolescence, especially peer groups that may be socially and emotionally rewarding, such as sports teams, clubs, and other extracurricular activities, to provide alternative behaviors to risk-taking.

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