EXTERNALIZING BEHAVIORS AS A RISK FOR UNINTENTIONAL INJURY IN CHILDREN

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EXTERNALIZING BEHAVIORS AS A RISK FOR UNINTENTIONAL INJURY IN CHILDREN

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ABSTRACT

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Previous research suggests that the presence of externalizing behaviors, such as hyperactivity and aggression, may impact the risk of childhood injury (Barton & Schwebel, 2007; Schwebel et al., 2007). However, studies have not examined these factors for preschool-aged children in a home environment. The present study examined the relationship between externalizing behaviors and injury risk behaviors of preschool children in a simulated living room that contained mock hazard items. Temperamental factors (e.g. inhibitory control, anger, activity, high intensity pleasure, and impulsivity) in relation to injury risk were also explored. Data collected from 89 preschool-aged children (43 girls, 46 boys) and their caregivers who participated in a larger faculty-led study (Safety Involving Brothers and Sisters; Brown Kirschman & Dodds) were included in this study. All videos were previously coded for a number of risk behaviors including the child placing their hand on a hazardous item and how long they touched the hazardous item. For this current study, videos were coded for acts of aggression and hyperactivity of the child. Results revealed a positive relationship between aggressive
acts in the simulated hazard room and amount of mock hazard items the child touched in the room. Additionally, a negative relationship between inhibitory control and amount of hazards the child touched in the simulated hazard room was found. These results help in identifying child attributes that may increase risk of home injury, which is an important first step in targeting prevention efforts.

Keywords: unintentional injury, externalizing behaviors, hyperactivity, aggression, temperament.
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# TABLE OF CONTENTS

ABSTRACT ................................................................................................. iii

ACKNOWLEDGEMENTS ......................................................................... v

LIST OF TABLES ....................................................................................... vii

CHAPTER I INTRODUCTION ................................................................... 1

CHAPTER II METHOD ............................................................................. 11

CHAPTER III RESULTS ........................................................................... 17

CHAPTER IV DISCUSSION ...................................................................... 24

REFERENCES .......................................................................................... 31

APPENDICES

A. Coding Manual ................................................................................... 38

B. Activity Level/Hyperactivity Coding .................................................. 40

C. Physical and Verbal Aggression Acts Coding ..................................... 41
LIST OF TABLES

1. Demographic Variables........................................................................................................... 12

2. Comparison of Boys and Girls on the Number of Hazards Touched................................. 18

3. Means and Standard Deviations of Temperamental Characteristics reported by parents from the CBQ............................................................................................................... 19

4. Pearson’s Correlation of Temperament and Injury Risk...................................................... 20

5. Means and Standard Deviations of Externalizing Behaviors reported by parents from the BASC-II........................................................................................................................................ 21

6. Means and Standard Deviations of Variables that were observed in the Simulated Hazard Room and Parent-Report of Injury.................................................................................. 21

7. Pearson’s Correlation of Parent-Report of Externalizing Behaviors and Injury Risk... 22
CHAPTER I
INTRODUCTION

Unintentional injury is the leading cause of death for children under the age of 18, killing more children than the next 20 leading causes of death combined (Centers for Disease Control and Prevention [CDC], 2010). According to the CDC, 33 children die every day from injuries that could have been prevented. Unintentional injuries, such as burns and poisonings, are also a major contributor to the hospitalization of children. For young children, many of these pediatric injuries occur in the home, where children should feel safest (WHO, 2006). In addition to health consequences, there are direct and indirect costs related to pediatric injuries (Morongiello & Schell, 2010). These costs include fiscal expenses associated with hospitalization of children as well as emotional costs such as loss, burden, and suffering that occur for the family because of the injury (Pastor & Reuben, 2006). Unintentional injuries are no longer considered “accidents” because of the preventable nature of injury (Krug, Sharma, & Lozano, 2010). Understanding factors that are related to pediatric injury is an important step in the prevention of such occurrences.

Unintentional injury risk in preschool-aged children

Preschool-aged children, in particular, are at high injury risk because of limitations in cognitive and physical development. For example, preschoolers have been
found to overestimate their own physical abilities such as how far they can jump or how fast they can run (Plumert, 1995). They also do not have the cognitive maturity necessary for good impulse control or delay of gratification. Parents have been found to overestimate preschooler’s abilities to follow household rules (Mayes et al, 2006). In addition to age, injury researchers have found other factors that relate to the risk of pediatric injuries. These factors include child gender, socioeconomic status, and certain child characteristics (e.g., temperament, psychological disorders; see Brown Kirschman, Mayes, & Perciful, 2009; Morrongiello, Schell, & Schmidt, 2010; Rowe et al., 2004;).

**Gender.** After the age of 2, boys have been found to have higher injury rates and sustain more serious injuries than girls (CDC, 2010). The difference in injury risk might be explained in part by differences in injury perceptions. Hillier and Morrongiello (1998) examined gender differences in how children perceive injury risk. Children ages 6 to 10 were asked to rate a series of photos depicting other children in high and low injury risk situations such as a child riding a bike with a helmet (low risk) and without a helmet (high risk). In this study, boys were less likely to perceive injury risk than girls. These authors concluded that boys are more likely to engage in injury risk behavior due to being less aware of the inherent risk involved in an activity. In contrast, girls may perceive higher levels of risk in situations and therefore choose not to participate in these activities.

Morrongiello and Dawber (1998) have also examined gender differences in injury risk in samples of young children. In toddler-aged children, boys were found to be more likely to approach and touch mock hazards than girls when placed in a simulated hazard room with their mothers. Additionally, boys were less compliant when their
mothers gave directions not to touch the hazardous objects, relative to the girls in the study. This study also illustrated the differences in how boys and girls are socialized by parents. For instance, boys in this study received more information on how to handle risky situations from mothers after they touched a hazardous object. Adversely, girls received more warnings about potential injury risk from the hazard itself. Morrongiello and Dawber (1999) studied the socialization of injury of children, ages 2 to 4 years, by examining the way parents communicated with their son or daughter during a potentially risky activity in a playground setting (e.g., going down a firehouse pole). The results of this study found a significant gender difference with how parents communicated with their child. Parents were most likely to communicate with boys in a way that could encourage more risk-taking behavior than with girls. For example, boys were observed to receive more pressure from parents to go down the firehouse pole than girls. Also, during risky play, parents were more likely to give physical assistance to daughters on the playground than sons.

**Socioeconomic Status.** Studies have shown that lower family socioeconomic status (SES) is related to higher injury rates in children (Yoshikawa, Aber, & Beardslee, 2012). Differences in injury rates may be explained by the negative impact that poverty can have on children’s lives, socially and environmentally (Garzon, Huang, & Todd, 2008). Because of the financial burdens of quality caregiving, children from low SES families may not receive adequate supervision when parents are not present, which in turn could increase likelihood of pediatric injury. The higher risk for unintentional injury in children from low SES families may also be influenced by the lack of resources available to these families for prevention (e.g., home safety devices) or the increase of
exposure to environmental hazards such as unsafe playground equipment (Birken et al., 2006).

Birken et al. (2006) used Canadian census data to examine the effect of SES level on death from unintentional injury in children from 1971 to 1988. This data included all children under the age of 14 who were living in urban neighborhoods and who were from families of low SES. They found that the lower the family SES, the higher the risk of childhood unintentional injury death. The specific types of death from unintentional injuries that were increased by lower SES were suffocation, falls, and pedestrians hit by a motor vehicle. In a similar population-based study of Korean children, Hong et al.’s (2010) study examined the relationship between parental SES and childhood unintentional injury deaths by using birth and death certificates of children under the age of 8 years old. The results of this study found that children of parents with lower SES were related to higher risk of injury death.

**Child Characteristics**

**Temperament.** Studies have examined specific temperamental characteristics (e.g., activity level, anger, inhibitory control, impulsivity) of children that are related to pediatric injury risk. Schwebel and Bounds (2003) found that children with higher impulsivity and higher activity levels, along with poor parental supervision, had an increased risk for unintentional injury. This was due to children with the aforementioned temperamental characteristics being more likely to take risks that may increase their likelihood to experience an injury event.

Barton and Schwebel (2007) examined inhibitory control and parental supervision in relation to children’s pedestrian behaviors. In this study, 85 children, ages
5 to 8 years, were instructed to cross a pretend road supervised by their parent and unsupervised. The researchers found that children with poor inhibitory control took greater risks in the pretend pedestrian setting.

**Psychopathology.** Children with certain behavioral disorders and psychiatric symptoms have been found to be at greater risk for injuries (Davidson et al., 1992; Discala Lescohier, Barthel, & Li, 1998; Lam et al., 2006; Swensen et al., 2004). Brehaut et al. (2002) examined injury risk in children with behavior disorders using a population-based analysis of all children living in British Columbia. They found that children with a diagnosis of behavior disorders (diagnosis based on prescription of psychiatric medication) had a 1.5 times greater likelihood of injury than children without behavior disorders. A number of clinical diagnoses have been shown to relate to injury risk in children. Lee et al. (2007) found that children with autism, Attention-Deficit Hyperactivity Disorder (ADHD), and other psychopathology (depression and anxiety) were 2 to 3 times more likely to experience an injury event.

Rowe, Maughan, and Goodman (2004) examined externalizing and internalizing disorders in children in relation to unintentional injury risk. By using a large-scale sample of 10,000 children ages 5 to 15 years, these researchers analyzed whether presence of certain disorders, including ADHD, Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), depression, and anxiety had a greater risk for unintentional injuries in children. Researchers found that depression was linked with childhood fractures, while anxiety was linked with poisonings and head injuries in children. They also found that ODD was independently related to childhood poisonings and burns and ADHD in children was related to an increase in childhood fractures.
Although several childhood disorders have been examined, support seems to be strongest for externalizing symptoms (Abboud Dal Santo et al., 2004). Children with impulsivity and other externalizing behavior problems such as aggression and oppositionality have been shown to have a higher vulnerability to unintentional injury (Garzon, Huang, & Todd, 2008). When children exhibit these behaviors they are more likely to engage in risk-taking that can increase their exposure to hazardous situations (Schwebel et al., 2002). For example, a child high in impulsivity may sustain pedestrian injuries when darting in front of traffic to recover a ball or a child with oppositional tendencies may be less likely to comply with parent directions regarding risky situations or follow home safety rules (Schwebel, Hodgens & Sterling, 2006). These disorders can impact cognitions and make it even more difficult for a child to perceive the possibility that an injury will occur or think through the other consequences of risky behaviors (Farmer & Peterson, 1995).

Children diagnosed with ADHD are more likely to have different injury perceptions. This finding is illustrated in work done by Farmer and Peterson (1995), who examined injury perceptions in two groups of children: young boys with ADHD and a control group. These two groups of children watched videos portraying child activities (e.g., riding a bicycle without a helmet, crossing a street between cars parked) and later discussed risky behaviors that they had seen. They found that children with ADHD discussed the severity of consequences of dangerous behaviors less frequently and noted fewer ways to prevent injury than the control group. Thus, children with ADHD may perceive fewer negative consequences when participating in risky behaviors and may consider preventative safety actions less often than children without ADHD.
Furthermore, studies also suggest ODD being related to frequency of childhood injuries. To exemplify, Schwebel et al. (2007) monitored 22 children in a 6-week summer camp with ADHD and ODD for injury incidents. Children who experienced symptoms of ODD had greater frequency of injuries, while those children that experienced symptoms of ADHD did not have significantly greater occurrence of injuries. This study supports other studies that suggest symptoms of ODD as more closely related to risk of unintentional injury for children than symptoms of ADHD (Byrne et al., 2003; Davidson, 1987). Given the high comorbidity of ODD and ADHD, however, additional research is still needed.

The Proposed Study

Studies have linked externalizing symptoms via parent report to injury risk behaviors. To date, however, there have been no studies that look at both parent report and behavioral indices of hyperactivity and aggression level with home injury risk behaviors in young children. Davidson (1987) stated that to examine the impact that hyperactivity has on unintentional injury in children, future research should include a behavioral measure of hyperactivity that is separate from maternal reports of activity level. Therefore, this study will view children participants directly engaging in an environment that is similar to a living room, with mock hazardous items around them, to understand the role of temperament and externalizing symptoms in children. Also, this current study will utilize standardized parent reports of externalizing behaviors such as hyperactivity, aggression, and behavioral indices of these tendencies via systematic coding in a simulated hazard room environment. The goal of this study is to examine the
risks that children may have for unintentional injury due to externalizing behaviors that they are exhibiting.

**Hypotheses for Current Study**

1. Consistent with the literature, gender and socioeconomic status of the child will relate to injury risk.
   a. Boys will engage in significantly more injury risk behaviors than girls in the simulated hazard room.
   b. SES will be negatively correlated with the frequency and duration of hazard touches.

2. Consistent with the literature, temperament (e.g., inhibitory control, activity, high intensity pleasure, and impulsivity) of the child will relate to injury risk.
   a. Activity, anger, impulsivity, and high intensity pleasure as reported by parents in the Children’s Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey & Fisher, 2001) will be positively correlated with mock hazard interactions.
   b. Temperament of the child as reported by parents from the CBQ will be significantly correlated with the duration of hazard touches
   c. Temperament of the child as reported by parents from the CBQ will be positively correlated to injury rates as reported by parents in their injury history.
d. Inhibitory control as reported by parents in the CBQ will be negatively correlated with mock hazard interactions.

e. Inhibitory control as reported by parents in the CBQ will be negatively correlated with the duration of hazard touches.

3. Children who are higher in externalizing behaviors as measured by parent report will demonstrate higher rates of injury risk behavior in a simulated hazard room.

   a. Externalizing behaviors exhibited by children in the simulated hazard room will be positively correlated with mock hazard interactions.

   b. Externalizing behaviors of the children reported by parents from the Behavioral Assessment Scale for Children 2- Parent Report for Preschool Version and Child/Adolescent Version (BASC-2; Reynolds and Kamphaus, 2004) will be positively correlated with mock hazard interactions.

4. Externalizing problem symptoms will be positively correlated with injury rates as reported by parents in their injury history.

5. Externalizing behaviors of children will partially mediate the effects of gender on unintentional injury risk.

6. Externalizing behaviors of children will partially mediate the effects of SES on unintentional injury risk.
7. Temperamental characteristics of children will partially mediate the effects of gender on unintentional injury risk.

8. Temperamental characteristics of children will partially mediate the effects of SES on unintentional injury risk.
CHAPTER II
METHOD

Participants

This current study uses an existing data set and results of videos from the Safety Involving Brothers and Sisters (SIBS) project (Brown Kirschman & Dodds, 2014). The original project was designed to examine the role of sibling supervision in home injury risk. The participants included 90 families with 180 total participating children from ages 3-11 years. Participants were recruited from a variety of community venues (e.g., pediatrician offices, flyers distributed at events for parents of young children). Two siblings from each family participated in the original study. The data from the child that is used in this study is the younger preschool-aged sibling. A demographic table is found in Table 1.
Table 1  

Demographic Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity of Child</td>
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<td></td>
</tr>
<tr>
<td>African American</td>
<td>15</td>
<td>16.9</td>
</tr>
<tr>
<td>Caucasian</td>
<td>64</td>
<td>71.9</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Native American</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Biracial</td>
<td>7</td>
<td>7.9</td>
</tr>
<tr>
<td>Parent’s Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>69</td>
<td>77.5</td>
</tr>
<tr>
<td>Divorced</td>
<td>7</td>
<td>7.9</td>
</tr>
<tr>
<td>Never Married</td>
<td>9</td>
<td>10.1</td>
</tr>
<tr>
<td>Never Married/Living Together</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Maternal Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 11</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Grade 12</td>
<td>8</td>
<td>9.0</td>
</tr>
<tr>
<td>Some College</td>
<td>16</td>
<td>18.0</td>
</tr>
<tr>
<td>College Grad</td>
<td>35</td>
<td>39.3</td>
</tr>
<tr>
<td>Grad/Prof Training</td>
<td>27</td>
<td>30.3</td>
</tr>
<tr>
<td>Missing</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Paternal Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 11</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Grade 12</td>
<td>12</td>
<td>13.5</td>
</tr>
<tr>
<td>Grade 13</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Grade 14</td>
<td>6</td>
<td>6.7</td>
</tr>
<tr>
<td>Grade 15</td>
<td>5</td>
<td>5.6</td>
</tr>
<tr>
<td>College Grad</td>
<td>25</td>
<td>28.1</td>
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<tr>
<td>Grad/Prof Training</td>
<td>26</td>
<td>29.2</td>
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<td>Missing</td>
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<td>13.5</td>
</tr>
<tr>
<td>Gross Family Income</td>
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<td></td>
</tr>
<tr>
<td>Under 10,000</td>
<td>7</td>
<td>7.9</td>
</tr>
<tr>
<td>10,000-19,999</td>
<td>5</td>
<td>5.6</td>
</tr>
<tr>
<td>20,000-29,999</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>30,000-39,999</td>
<td>5</td>
<td>5.6</td>
</tr>
<tr>
<td>Annual Income Range</td>
<td>Number</td>
<td>Mean</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------</td>
<td>------</td>
</tr>
<tr>
<td>40,000-49,999</td>
<td>9</td>
<td>10.1</td>
</tr>
<tr>
<td>50,000-59,999</td>
<td>3</td>
<td>3.4</td>
</tr>
<tr>
<td>60,000-79,999</td>
<td>17</td>
<td>19.1</td>
</tr>
<tr>
<td>80,000-99,999</td>
<td>12</td>
<td>13.5</td>
</tr>
<tr>
<td>Over 100,000</td>
<td>24</td>
<td>27.0</td>
</tr>
<tr>
<td>Missing</td>
<td>2</td>
<td>2.2</td>
</tr>
</tbody>
</table>

**Materials**

**Family Information Form.** This form was completed by the parent and consists of information about the children’s demographics, parental marital status, ethnicity, education level of parents, child’s mental health history, and gross family income. The questions about the child’s mental health history include “Does your child have any behavior or learning problems at home or school?” and “if yes, please explain (include diagnosis if relevant, for example ADHD)”. This measure was created for the original study.

**Injury History Interview.** A semi-structured interview was conducted to acquire information about the nature and type of injuries the child has had in the past. The questionnaire form was completed by a research assistant while interviewing the parent about the injuries the child in the study has sustained during the course of his or her life. This included minor and major injuries and the parent was prompted by injury type (e.g., head injuries, lacerations). The information includes type of injury, how the injury happened, and age of the child during the injury. The injury history was designed and completed as part of the primary sibling supervision study.

**The Behavioral Assessment Scale for Children 2- Parent Report for Preschool Version and Child/Adolescent Version (BASC-2; Reynolds and Kamphaus, 2004).** This measure was completed by the parent and assesses externalizing and internalizing problems that their child displays. The externalizing problems include
hyperactivity, aggression and conduct problems. The internalizing problems include anxiety, depression, and somatization (overly sensitive/complaining about minor physical problems/discomfort). The parent completed this form for the younger sibling (ages 3-5) and the older sibling (ages 6-11). The T-Scores of the internalizing and externalizing problems were composited and T-Scores, which were scored at 60 and above were considered to be high, while T-Scores 59 and under were considered to be low/average. T-scores were used in the study analyses.

The Children’s Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey & Fisher, 2001). This measure was completed by the parent and assesses child temperamental factors. These factors include inhibitory control, impulsivity, activity level, anger, and high intensity pleasure. The parent completed this form for the younger sibling (ages 3-5). The T-Scores of the temperamental factors were composited and T-Scores, which were scored at 60 and above were considered to be high, while T-Scores 59 and under were considered to be low/average. T-scores were used in the study analyses.

Other measures. The measures not used for this current study, but given to the primary caregiver to complete for previous and future studies included: The Sibling Inventory of Behavior (SIB; Schaefer & Edgerton, 1981) and Structured Interview on Room Hazards (Brown et al., 2005).

Procedure

Videos from the Simulated Hazard Room. The hazard room was designed to replicate a typical living room in a home. In the room there were a number of items that looked as if they were an actual hazard, but were designed to be safe or not work entirely.
These “safe” hazardous items included a disengaged cigarette lighter, a dull 3-inch knife, fake medicine in a pill container (pills replaced with candy), and bottles of cleaners (filled with apple juice). The knife and cigarette lighter used in this study were the same stimuli that were used in research by Brown et al. (2005) and Boles and Roberts (2008). This hazard room also incorporated safe and appropriate toys and games such as puzzles, blocks, and crayons. One older and one younger sibling were placed in the room for approximately 20 minutes and videotaped. The videos were used to create a coding manual.

**Video Coding of Externalizing Behaviors.** A coding manual was created for this study (see Appendix A). Each video was coded for the items above in randomized 1-minute increments for a total of 5 minutes of the 20-minute video. Reliability checks were conducted at 20% by each coder. All of the videos in this study were coded for a number of behaviors including: hyperactivity level, physical aggressive acts, and verbal aggressive acts (see Appendix B and Appendix C). *Hyperactivity levels* were coded by measuring how much the child moves around the room. This was measured by using a computer application named *Mousotron™*. This application measures the length (in inches) that the child is moving across the screen by following their movements with the computer mouse cursor. *Physical aggression acts* were coded for the number of times the child displayed physical aggression (i.e., hitting, pushing, punching, throwing objects). *Verbal aggression acts* were coded for the number of times the child displayed verbal aggression (i.e., yelling, teasing, using profanity). Total number of physical aggression acts and verbal aggression acts were calculated.
**Video Coding of Injury Risk Behavior.** The videos were previously coded for injury risk behaviors of the children in the simulated hazard room as part of a larger project. This was coded for the full 20-minute length of each video for each child. These behaviors included the total number of hazard items touched, the length of hazard exposure (in seconds), and the type of hazard item touched.
CHAPTER III

RESULTS

Preliminary Analyses and Interrater Reliability

Preliminary analyses consisted of screening for outliers in the dataset by using a histogram and a stem and leaf plot to determine if there were data points that fell away from the extremes. To determine interrater reliability for the observational data, a second coder coded 20% of the observational data that was randomly assigned. Intraclass correlation coefficients were calculated to assess how consistent the two raters were in the measurement of externalizing behaviors in the mock hazard environment. For the observational data for hyperactivity, the intraclass correlation coefficient was .89. For the observation data for aggression, the intraclass correlation coefficient was .76. Additionally, Cohen’s Kappa for number of hazards touched, which was previously coded for, was .83. According to Cohen & Cohen (1983), reliability for hyperactivity, aggression, and number of hazards touched is adequate because reliability measures greater than .70 is considered to be high reliability. After viewing discrepant cases, the primary investigator’s coding was used in the analysis of the data.
Primary Analyses

Hypothesis I

The first hypothesis stated that gender and socioeconomic status of the child would relate to injury risk. Inspection of the two group means indicate that the average amount of hazard touches for boys (M = 3.26) is not significantly different than the average number of hazard touches for girls (M = 3.45; See Table 2). Further, a Pearson’s correlation found that socioeconomic status was not significantly related to injury risk (r = -.07, p > .05).

Table 2

Comparison of Boys (n=46) and Girls (n= 43) on the Number of Hazards Touched

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Hazards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>3.26</td>
<td>3.44</td>
<td>1.68</td>
<td>83</td>
<td>.11</td>
</tr>
<tr>
<td>Girls</td>
<td>3.45</td>
<td>4.73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis II

The second hypothesis stated that temperament of the child would relate to injury risk. The means and standard deviations of temperamental characteristics are reported in Table 3. Activity, anger, impulsivity, nor high intensity pleasure were related to number of mock hazard items the child interacted with in the simulated hazard room. Another part of this hypothesis was that inhibitory control and injury risk would be negatively correlated. A significant negative correlation was found between inhibitory control of the child and injury risk (r = -.23, p < .05). In other words, lower inhibitory control, according to parent-report on the CBQ, was significantly related to a higher
number of hazards the child interacted with in the simulated hazard room. The temperament of the child (e.g. activity level, anger, impulsivity, high intensity pleasure, and inhibitory control) was not related to injury rates reported by parents in their injury history. The correlations between injury risk and child characteristics are reported in Table 4.

Table 3

*Means and Standard Deviations of Temperamental Characteristics reported by parents from the CBQ*

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>65.39</td>
<td>11.41</td>
</tr>
<tr>
<td>Anger</td>
<td>60.46</td>
<td>11.95</td>
</tr>
<tr>
<td>Impulsivity</td>
<td>60.91</td>
<td>11.69</td>
</tr>
<tr>
<td>High Intensity Pleasure</td>
<td>65.57</td>
<td>11.94</td>
</tr>
<tr>
<td>Inhibitory Control</td>
<td>60.81</td>
<td>10.18</td>
</tr>
</tbody>
</table>
Table 4

*Pearson’s Correlation of Temperament and Injury Risk*

<table>
<thead>
<tr>
<th>Variable</th>
<th>ACT</th>
<th>ANG</th>
<th>IMP</th>
<th>HIP</th>
<th>IC</th>
<th>HAZ</th>
<th>INJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>ANG</td>
<td>.33**</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>IMP</td>
<td>.67**</td>
<td>.21</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>HPI</td>
<td>.53**</td>
<td>.00</td>
<td>.71**</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>IC</td>
<td>-.42**</td>
<td>-.31**</td>
<td>-.48**</td>
<td>-.14</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>HAZ</td>
<td>-.00</td>
<td>.10</td>
<td>.15</td>
<td>.03</td>
<td>-.23*</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>INJ</td>
<td>-.02</td>
<td>.05</td>
<td>.01</td>
<td>.07</td>
<td>-.10</td>
<td>.10</td>
<td>--</td>
</tr>
</tbody>
</table>

*Notes.* *p < .05. **p < .01. ACT = Activity Level, Anger = Anger, IMP = Impulsivity, HIP = High Intensity Pleasure, IC = Inhibitory Control, HAZ = Number of mock hazard items child touched, and INJ = Average number of prior child injuries per year as reported by parents.

**Hypothesis III**

The third hypothesis stated that children who are higher in externalizing behaviors as measured by parent report would demonstrate higher rates of injury risk behavior in the simulated hazard room. The means and standard deviations of externalizing behaviors from the BASC-II are reported in Table 5. Pearson’s correlation analysis found that externalizing behaviors of the children reported by parents from the BASC-2 are not related with mock hazard interactions ($r = .02, p > .05$). It was hypothesized that externalizing behaviors exhibited by children in the simulated hazard
room will be positively correlated with mock hazard interactions. The results found that aggression acts that were observed in the simulated hazard room were significantly positively correlated to mock hazard interactions in the simulated hazard room \((r = .26, p < .05)\). However, hyperactivity that was observed in the simulated hazard room was not significantly related to mock hazard interactions \((r = .18, p > .05)\). In other words, children that exhibited more aggression acts in the simulated hazard room exhibited a higher number of interactions with mock hazard items. Means and standard deviations of study variables can be found in Table 6.

Table 5

*Means and Standard Deviations of Externalizing Behaviors reported by parents from the BASC-II*

<table>
<thead>
<tr>
<th>Variables</th>
<th>(M)</th>
<th>(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperactivity</td>
<td>52.89</td>
<td>10.75</td>
</tr>
<tr>
<td>Aggression</td>
<td>51.99</td>
<td>10.79</td>
</tr>
<tr>
<td>Externalizing Problems</td>
<td>53.32</td>
<td>12.02</td>
</tr>
</tbody>
</table>

Table 6

*Means and Standard Deviations of Variables that were observed in the Simulated Hazard Room and Parent-Report of Injury*

<table>
<thead>
<tr>
<th>Variables</th>
<th>(M)</th>
<th>(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Acts of Aggression</td>
<td>.74</td>
<td>.19</td>
</tr>
<tr>
<td>Hyperactivity (inches)</td>
<td>83.08</td>
<td>163.26</td>
</tr>
<tr>
<td>Number of Hazards Touched</td>
<td>4.12</td>
<td>3.40</td>
</tr>
<tr>
<td>Duration of Hazards Touched (seconds)</td>
<td>74.35</td>
<td>38.69</td>
</tr>
<tr>
<td>Parent-Report of Injury</td>
<td>.39</td>
<td>.41</td>
</tr>
</tbody>
</table>
**Hypothesis IV**

The fourth hypothesis stated that externalizing problem symptoms would be positively correlated to number of previous injuries reported by parents on the Injury History Interview. Hyperactivity, aggression, nor externalizing behaviors as reported by the parents on the BASC-2 were related to parent-reports of previous injuries. The correlations are summarized in Table 7.

**Table 7**

*Pearson’s Correlation of Parent-Report of Externalizing Behaviors and Injury Risk*

<table>
<thead>
<tr>
<th>Variables</th>
<th>HYP</th>
<th>AGG</th>
<th>EB</th>
<th>INJ</th>
<th>HAZ</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYP</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGG</td>
<td>.67*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EB</td>
<td>.67*</td>
<td>.77*</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INJ</td>
<td>.09</td>
<td>.09</td>
<td>.13</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>HAZ</td>
<td>.08</td>
<td>.05</td>
<td>.02</td>
<td>.09</td>
<td>--</td>
</tr>
</tbody>
</table>

*Notes. *p < .05. **p < .01. HYP = Hyperactivity, AGG = Aggression, EB = Externalizing Behaviors, INJ = Average number of prior child injuries per year of age as reported by parents, and HAZ = Number of mock hazard items child touched.*

**Hypothesis V, VI, VII and VIII**

The fifth hypothesis stated that externalizing behaviors of children would partially mediate the effects of gender on unintentional injury risk. To test for mediation, a bootstrapping procedure was used. This method using a resampling approach and does not assume normal distribution of the data (Preacher & Hayes, 2008). Using this mediation model, externalizing behaviors did not mediate the effect of gender on
unintentional injury risk. The sixth hypothesis stated that externalizing behaviors of children would partially mediate the effects of SES on unintentional injury risk. This mediation model found that externalizing behaviors did not mediate the effect of SES on unintentional injury risk. The seventh hypothesis stated that temperamental characteristics of children would partially mediate the effects of gender on unintentional injury risk. Using a mediation model with bootstrapping, temperamental characteristics did not mediate the effect of gender on unintentional injury risk. The eighth hypothesis stated that temperamental characteristics of children would partially mediate the effects of SES on unintentional injury risk. Using this mediation model, temperamental characteristics did not mediate the effect of SES on unintentional injury risk.
This study examined whether a relationship existed between externalizing behaviors of children and their risk for unintentional injury in a simulated hazard room environment. Earlier studies have found that children with behavioral disorders are at greater risk for unintentional injuries (Davidson et al., 1992; Discala et al., 1998). A recent observational study found that children with symptoms of ODD had a greater frequency of pedestrian injury than children without ODD (Schwebel et al., 2007). This current study coded videos of children in a simulated hazard room to see if observed externalizing behaviors of the children influenced their injury risk in the home setting. The remainder of this chapter will review the implications of the findings along with the limitations of the study and future directions for research.

**Externalizing Behaviors in Relation to Child Injury Risk.**

It was hypothesized that externalizing behaviors (e.g., aggression and hyperactivity) would be positively correlated with injury risk, as has been demonstrated in previous studies (Davidson et al., 1992; Discala et al., 1998; Rowe, Maughan, & Goodman, 2004). This hypothesis was partially supported. Children who exhibited aggression in the simulated hazard room demonstrated more frequent hazard touches in the room. Past research studies have found a relationship between the oppositional behavior of childhood aggression, specifically, and pediatric injury risk.
(Garzon, Huang, & Todd, 2008; Abboud Dal Santo et al., 2004). For example, in a longitudinal study of 271 U.S. children who were interviewed annually from Grade 4 to Grade 7, Cobb et al. (1995) found that childhood aggression was a predictor for later injury during adolescence. Further, children with a formal diagnosis of ODD have been found to be at greater risk for injury than children who do not have a clinical diagnosis of this type (Schwebel et al., 2007). One primary externalizing symptom of ODD is aggression, which is consistent with the current finding that aggressive acts by children in the simulated hazard room were related to behaviors that would put them at risk for injury if the mock hazards were real.

Although there was some support for the relationship between observed aggression and injury risk, a significant relationship between level of hyperactivity in the simulated hazard room and number of hazard interactions in the room was not found. Also, parent reports of children’s externalizing behaviors (e.g., hyperactivity, aggression) were similar to observed hyperactivity and were not related to in-room hazard interaction. These findings are not consistent with past studies that have found significant relationships between parent reports of externalizing behaviors and unintentional injury (Abboud Dal Santo et al., 2004, Garzon, Huang, & Todd, 2008; Rowe, Maughan, & Goodman, 2004).

While it is unclear why there was not a significant relationship between hyperactivity and amount of hazard items touched, it may be related to the age of the children in this study. In many studies of hyperactivity and childhood injury, participants are in middle childhood (Schwebel et al., 2011; Schwebel et al., 2007). However, children in this study were of preschool age, a time when children are naturally very
active. Moreover, preschool-aged children are at a higher risk of certain types of injury during this developmental period because of their increased mobility and motor development combined with their undeveloped executive control (Abboud Dal Santo et al., 2004). To specify, earlier in development children lack the motor skills to get to hazards quickly, while later in development they may have slightly better executive functioning skills that may allow them to “stop and think” before interacting with hazards. If most children are relatively active during preschool-age and are moderately injury prone, it may be difficult in this study to differentiate those children at most risk for injury due to hyperactivity because of limited variability.

Failure to produce a significant relationship between hyperactivity and hazard interaction might also be explained by the room contents and particularly, those items selected as “hazards.” Some children may have viewed the mock hazard items, like a cigarette lighter or a pill container, as less novel than some of the toys in the room. The child’s environment and previous exposures would make certain items more or less interesting. Children with higher levels of hyperactivity may have simply not interacted with the mock hazards because other items in the room (e.g., such as a 1970s handheld video game, building blocks) were considered to be more novel to them. Future research utilizing a simulated hazard room should explore the novelty of the items that are being used and the possible previous experiences that the children participants may have had with these items.

**Temperament in Relation to Child Injury Risk.**

Child temperament has been related to injury risk behaviors (Rowe, Smirnoff, & Silberg, 2006). In this current study, children’s inhibitory control was negatively
correlated to childhood injury risk. Thus, children with higher inhibitory control
demonstrated fewer interactions with mock hazard items in the simulated hazard room.
This finding is consistent with past studies on inhibitory control and other injury types,
such as risk of pediatric injury (Schwebel et al., 2007; Barton & Schwebel, 2007;

Rothbart (2001) defines inhibitory control as “capacity to plan and to suppress
inappropriate approach responses under instructions or in novel or uncertain situations”
(p. 1406). Mock hazards in the simulated hazard room may have been novel to the
children. Children with lower inhibitory control, as explained in the definition, may find
the mock hazard items as interesting and new and may not be able to stop themselves
from touching the hazards.

**Demographic Factors in Relation to Child Injury Risk**

It was hypothesized that SES of the family and gender of the child would relate
to unintentional injury risk because of past studies that have found these demographic
factors as significantly related to pediatric injury (Birken et al., 2006; Hillier and
Morrongiello, 1998; Morrongiello and Dawber, 1999; Yoshikawa, Aber, & Beardslee,
2012). Unexpectedly, support was not found for these relationships in the current study.
A reason for these findings could be because the majority of participants in this study
were Caucasian (71%) and having an income of greater than $60,000 (59%), therefore a
more diverse sample would be beneficial in future research. Nevertheless, the findings
that demographic variables relate to childhood injuries, including medically attended
injuries are fairly strong even in samples with limited diversity (Morrongiello & Dawber,
1999). With nearly 24% of the sample reporting income of under $40,000, and
approximately equal numbers of boys and girls, the lack of support for gender or income differences is unanticipated.

There is a possibility that there is something specific about the home environment, supervision, or parent attitudes that increases risk for certain groups. For example, Morrongiello and Dawber (1999) found that parent attitudes towards injury along with their level of attentive supervision was different for boys and girls in a playground setting, and consequently increased injury risk for boys. In the current study, we were able to isolate child behavior with hazards separate from supervision levels or individual differences in a home environment (e.g., lack of safety devices due to inability to afford them). Further research should include investigating relationships between parental attitudes towards injury for children with externalizing behaviors.

**Limitations and Future Directions.**

There were a few inconsistencies that were found between the findings in this study and findings from past research studies on the relationship between externalizing behaviors and injury risk. These inconsistencies could be explained through several ways. One limitation of this study is the smaller sample size of participants that were used (n=89). Power for this study varied from .15 to .17, which means that there was a low chance that the analysis conducted could have detected the relationship between externalizing behaviors and injury risk. A larger number of participants would yield a higher power and possibly significant results.

Another limitation is the way that hyperactivity was coded for in the simulated hazard room. There are multiple approaches that hyperactivity could be measured observationally. For instance, this study measured hyperactivity in children through
physical movement around the simulated hazard room by using the computer software *Mousotron™*. Other methods of measurement may have been able to gain a better understanding of the children’s hyperactivity level. Because the primary study focused on sibling supervision and injury risk and the data had been gathered prior to the start of this thesis project, other approaches to code for externalizing behaviors could not be utilized. For example, the preferred standard of behavioral measurement of activity level and hyperactivity is via an actigraph, which is a wristband that monitors movement and may be more sensitive in the individual differences in activity level in young children (Teicher, 1995).

A strength of the current study was the incorporation of parent report and observation data related to the major study variables of hyperactivity, aggression, and pediatric injury. However, the age of the children prevented including a self-report measure, which would have provided a more thorough assessment of these variables. In the examination of childhood injury and behavior in children, parents may feel that they should report that they are keeping their children safe and that their children are well behaved. Because these children were preschool-aged, parents may feel increased pressures to “fake good” because it is a reflection of their own parenting. With that said, a limitation of this study is that the BASC-II does not take into account the possibility of the parents reporting in a socially desirable way. However, there was much care taken to normalize injury reports to gather the most accurate information.

A limitation of this study is parents underreporting their children’s behaviors. Loeber, Green, and Lahey (2010) reported that clinicians found teacher reports of children’s hyperactivity level as more accurate than maternal reports of these behaviors.
Furthermore, Murray et al (2007) found that teachers are moderately likely to concur with parents on the presence or absence of ADHD symptoms for preschool aged children. Thus, obtaining both a parent and a teacher report of the children’s behaviors may be beneficial in understanding the bigger picture of children’s functioning.

As discussed earlier, a simulated hazard room with mock hazards was utilized in this study and the amount of hazards touched was used to assess injury risk. Another strength of this current study is the children in the simulated hazard room were not told that they were being videotaped or that there were fake hazards in the room. Hence, the children were not likely to behave in a socially desirable way. However, a limitation of this study may be that the children’s behavior in the simulated hazard room was situation-dependent and may change when in a different context (Saluja et al., 2004). Future researchers should assess injury risk in multiple settings, which could include a simulated hazard room in a lab setting and in the children’s natural setting (e.g. home, school).
REFERENCES


Rowe, R., Maughan, B., & Goodman, R. (2004). Childhood psychiatric disorder and


APPENDIX A

Coding Manual

Steps for Activity Level/Hyperactivity Coding
Step 1: Turn on computer.
Step 2: Open video written in ID number section above in documents folder.
Step 3: Open the Mousotron™ application.
Step 4: Make the video full screen (Can do this by using keyboard shortcut ALT+Enter)
Step 5: Place the time on Time (1, 2, 3, 4, or 5) written in Appendix B.
Step 6: Point the mouse cursor on the younger sibling.
Step 7: Record the inches at play in Appendix B from the Mousotron™ application
Step 8: Use keyboard shortcut CTRL+P to play video.
Step 9: Follow child’s activity for 1 minute by keeping mouse on child’s head.
Step 10: Once the time has ended use keyboard shortcut CTRL+P to pause video.
Step 11: Record the inches at stop in Appendix B from the Mousotron™ application.
Step 12: Calculate total inches of movement (inches stop – inches play).
Step 13: Move to the next time (2, 3, 4, or 5) indicated in Appendix B and repeat steps 5-12.

Steps for Physical and Verbal Aggression Coding
Step 1: Turn on computer.
Step 2: Open video written in ID number section above in documents folder.
Step 3: Make the video full screen (Can do this by using keyboard shortcut ALT+Enter)
Step 4: Place the time on Time (1, 2, 3, 4, or 5) written in Appendix C.
Step 5: Read the definition of Physical and Verbal Aggression Acts in Appendix C.
Step 6: Use keyboard shortcut CTRL+P to play video.
Step 7: Tally for each Physical Aggression Act and Verbal Aggression Act under each respective column.
Step 8: Once the time has ended use keyboard shortcut CTRL+P to pause video. Rewind and repeat as needed for coding accuracy.
Step 9: Total the number of tallies for Physical Aggression and record this number under ‘Total’ next to the respective time
Step 10: Total the number of tallies for Verbal Aggression and record this number under ‘Total’ next to the respective time
Step 11: Calculate the total number of each Time (1-5) for Physical Aggression Acts in Times 1-5 and record number in the ‘Total’ for Times 1-5.
Step 12: Calculate the total number of each Times (1-5) for Verbal Aggression Acts in Times 1-5 and record number in the ‘Total’ for Times 1-5.
Step 13: Add the two ‘Totals’ for Times 1-5 and record in the Total for all Aggression Acts (Physical and Verbal) for Times 1-5.
Step 14: Move to the next time (2, 3, 4, or 5) indicated in Appendix C and repeat steps
APPENDIX B

Activity Level/Hyperactivity Coding

<table>
<thead>
<tr>
<th>Time</th>
<th>Inches at play</th>
<th>Inches at stop</th>
<th>Total Inches of movement (Inches at stop – Inches at play)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 3</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 4</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 5</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**APPENDIX C**

Physical and Verbal Aggression Acts Coding

**Number of Physical Aggression Acts:** Includes the child hitting the sibling by putting physical exertion on the sibling in ways such as pushing, punching. Throwing an object at a child.

**Number of Verbal Aggression Acts:** Includes the child yelling at their sibling, teasing a child, or using profanity.

<table>
<thead>
<tr>
<th>Time</th>
<th>Physical Aggression Acts</th>
<th>Total</th>
<th>Verbal Aggression Acts</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 3</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 4</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 5</td>
<td>(Minute ___ to ___)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total for Times 1-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total for all Aggression Acts (Physical and Verbal) for Times 1-5: ____