

How Temperament and ADHD Predict Child Pedestrian Injury

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Objective

Pedestrian injury is among the leading causes of death for American children ages 7-10 (NCIPC, 2008), but the behavioral factors that underlie pediatric pedestrian injury risk and pedestrian risk-taking remain poorly understood. Two factors that appear to contribute are temperament and Attention-Deficit/Hyperactivity Disorder (ADHD). Although conceptually similar, temperament and ADHD diagnoses are orthogonal traits. Children with ADHD can have widely varying temperament-driven behavior patterns. To date, no research has examined the effect of temperament on pediatric pedestrian injury within children already at increased risk of pedestrian injury because of their ADHD symptomatology (DiScala, Lescohier, Barthel, & Li, 1998).

This study examined the effect of temperament on children's pedestrian injury risk within a sample of children diagnosed with ADHD. In doing so, we considered both cognitive and emotional expressions resulting from temperament (Morrongiello & Matheis, 2007). Further, because the relative contributions of emotional expression and cognitive function to intellectual functioning remain controversial (e.g., Bastian, Burns, & Nettelbeck, 2005; Salovey & Mayer, 1994), but appear to suggest cognition and intellect are more closely tied than are emotion and intellect, we considered the moderating role of intelligence on the relative contribution of cognitive-based and emotion-based temperament to children's pedestrian safety. We expected more intelligent children with ADHD might experience greater contributions to their risk-taking tendencies from cognitive-based temperament traits whereas less intelligent children might be more influenced by emotion-based temperament in their risk-taking.

Method

Participants: Thirty-nine children aged 7 to 10 (mean age = 9.20 years; $SD = 1.25$) participated. All had been diagnosed with ADHD by a medical team of licensed physicians and psychologists at local university clinics (72% male; 54% black).

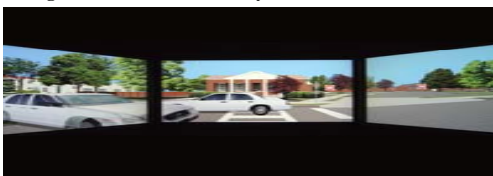
Measures:

Temperament was measured by parent report on the Temperament in Middle Childhood Questionnaire (TMCQ; Simonds & Rothbart, 2004). The measure includes 157 items that are rated on a 5-point Likert scale. For this study, we were particularly interested in four subscales. We considered two to be cognitive-based temperament traits (Attentional Control and Inhibitory Control) and two to be emotion-based (Anger and Fear).

Cognitive Ability was measured by the 2-subtest short form of the Wechsler Ability Scales of Intelligence (WASI; Wechsler, 1999). Children completed the Matrix Reasoning and Vocabulary subtests to yield an estimated full scale IQ score. For analyses, children were split into two groups based on IQ scores, those with IQs ≥ 100 and those with IQs < 100 . No children fell into the mental retardation range of IQ (IQs < 70).

Pedestrian Injury Risk was gauged by performance in an immersive, interactive virtual reality (VR) environment (Figure 1; Schwebel, Gaines, & Severson, 2008). Children crossed the virtual street 10 times and several pedestrian variables were electronically coded. Of particular interest in this study was the measure of hits/close calls, or the number of times (out of 10) when the child was hit or within one second of being hit by a virtual vehicle while crossing.

Figure 1. Virtual Reality Environment Crosswalk



Results

No significant relations emerged between temperament and pedestrian injury risk among the full sample of children with ADHD (See Table 1). We then divided the sample into two groups, those with IQ below 100 and those with IQ above or equal to 100, to examine the moderating role of IQ on the relation between temperament and pedestrian risk-taking. Tables 2 and 3 display correlations between temperament and pedestrian safety among the two groups. As shown, among children in the group with IQ less than 100, those rated as being less angry were more likely to experience hits/close calls in the virtual environment ($r = -.50, p < .01$). Among children with IQs greater than or equal to 100, those whose parents reported less attentional control ($r = -0.63, p < .05$), less inhibitory control ($r = -0.61, p < .05$), and more anger ($r = 0.64, p < .05$) experienced more hits/close calls in the virtual environment.

Table 1. Intercorrelations Among Temperament Variables and Pedestrian Injury Risk for Full Sample

Temperament	Hits/Close Calls
Cognitive	
Attentional Control	- 0.05
Inhibitory Control	- 0.18
Emotional	
Anger	- 0.02
Fear	0.15

Table 2. Intercorrelations Among Temperament Variables And Pedestrian Injury Risk for IQ < 100

Temperament	Hits/Close Calls
Cognitive	
Attentional Control	0.26
Inhibitory Control	- 0.10
Emotional	
Anger	- 0.50**
Fear	- 0.06

** $p < 0.01$

Table 3. Intercorrelations Among Temperament Variables And Pedestrian Injury Risk for IQ ≥ 100

Temperament	Hits/Close Calls
Cognitive	
Attentional Control	- 0.63*
Inhibitory Control	- 0.61*
Emotional	
Anger	0.64*
Fear	0.52

* $p < 0.05$

Conclusion

Previous work suggests temperament plays a significant role in risks for both general child injury (Schwebel & Barton, 2006) and child pedestrian injury (Barton & Schwebel, 2007). There is very little research examining how temperament might contribute to injury risk among subgroups of children already at increased risk of injury, such as children with ADHD (DiScala et al., 1998). Developmental disabilities such as ADHD are believed to increase risk of pedestrian injury via a number of channels, including poor attention skills, increased impulsivity to cross roads and reach destinations, and possibly oppositional behavior against traffic safety rules. Although one would expect temperament might also influence pedestrian safety risk-taking in children with ADHD, above and beyond the influence of ADHD symptoms, that relation had not been tested previously.

Results from this pilot study suggest temperament may play a role in pedestrian injury risk among children with ADHD, and that the role might be moderated by children's intelligence. We found that both cognitive-based temperament (attentional control, inhibitory control) and emotion-based temperament (anger) predicted pedestrian risk-taking among children with ADHD and higher intelligence scores. Among the children with lower intelligence scores, the only predictor of hits/close calls in the virtual road was lower levels of anger, an emotion-based temperament trait that emerged in the opposite direction from what was predicted.

The children with higher intelligence presumably have more sophisticated cognitive skills, and therefore it is not surprising that both cognition-based and emotion-based temperament might influence their risk-taking behavior in pedestrian settings. Children with lower intellectual abilities may be driven more by emotion-based processing, although it is difficult to explain why lower levels of anger in those children were related to higher levels of risk-taking.

In summary, the results suggest both cognitive and emotional aspects of temperament relate to child pedestrian injury risk among children with ADHD and above average intellectual abilities (Morrongiello & Matheis, 2007). Among children with ADHD and lower than average intelligence, only emotion-based temperamental traits were related to pedestrian risk-taking. We stress that this was a small study and that further research with larger samples is needed to replicate and further explore our findings. Following replication, pedestrian safety training initiatives could use this information to tailor interventions for at-risk groups such as children with ADHD. For example, children with ADHD and average to above average intelligence might be taught cognitive strategies to inhibit impulses and to attend to stimuli when engaging in potentially dangerous pedestrian environments. Fear-inducing tactics, though controversial, may also have merit in training at-risk children, including those with lower than average intellectual abilities, to behave safely in pedestrian environments.

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