Visual Attention in ADHD and Risky Pedestrian Behavior

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Objective

On the surface, one might think of pedestrian safety as a single task. In reality, however, pedestrian safety is comprised of several overlapping cognitive and perceptual components. One critical component is visual attention (Barton, 2006). This study examined the role of visual attention in pedestrian injury risk among typically developing children and those at elevated injury risk due to diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD), a disorder characterized by inattentive behavior. We hypothesized both ADHD diagnosis and low scores on a cognitive measure of visual attention would predict risky child pedestrian behavior, as indicated by poor attention to oncoming traffic in a virtual pedestrian environment.

Method

Participants: Seventy-eight children ages 7-10 participated (mean age = 9.17 years; SD = 1.24). Half were diagnosed with ADHD and the other half were age- and sex- matched controls (71% male; 52% Caucasian).

Measures: Collected as part of a larger study examining pediatric pedestrian injury risk, three measures were of interest in this investigation:

Visual Attention. Two visual attention subtests of the pediatric neuropsychological battery, the NEPSY, were administered (Korkman, Kirk, & Kemp, 1998). Both tasks assessed the ability of the participant to focus and maintain attention to a visual target within an array. On the "cats" task, participants searched for pictures of a target cat embedded in a random array of many different pictures. On the "faces" task, participants searched for pictures of two target faces that were embedded among faces differing in various features, such as the eyes or eyebrows. Raw scores (number of targets marked - number of errors) and completion times were combined for the two subtests. The total score was converted to a scaled score, which accounted for child's age and was used in subsequent analyses.

ADHD Diagnosis. ADHD diagnosis was made by a medical team that included licensed child psychologists and pediatricians. The diagnosis was made after completion of a lengthy assessment battery.

Pedestrian Safety. Children completed 10 street-crossing trials in an immersive, interactive virtual pedestrian environment (Schwebel, Gaines, & Severson, 2008; Figure 1). The virtual environment displays bidirectional traffic, which children watch to judge when it is safe to cross the street.

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When they deem it safe, children step off a wooden curb and then watch an avatar cross the street, representing what would have happened in a real-world crossing. A video camera, placed above the three monitors, recorded the child's face as he/she checked the right and left screens for traffic; this permitting coding of attention to traffic, quantified by the number of times the child's head turned left or right (inter-rater reliability = .99 on 20% of sample coded independently by 2 research assistants). The number of times the participant looked left and right was summed and then divided by the amount of time one waited on the curb before crossing to yield a measure of attention to traffic.

Figure 1. Virtual Reality Pedestrian Environment.

Results

Table 1 presents descriptive data from the overall sample and from the sub-samples of children with ADHD and children without ADHD. As shown, children with ADHD tended to be less attentive to traffic and to have lower scores on the NEPSY visual attention battery. The difference on the NEPSY was statistically significant.

Linear regression results suggested child performance on the NEPSY visual attention subscale predicted attention to traffic (B = 0.59, β = 0.25, $p < .05$; Table 1). However, results suggested that ADHD status does not predict the number of looks left and right for traffic while deciding when to cross the virtual street (B = -1.68, β = -.12, p = ns; Table 2). When NEPSY and ADHD status were entered simultaneously, NEPSY score (B = 0.56, β = 0.23, $p < .05$) but not ADHD status predicted attention to traffic (Table 3).

Table 1. Means (SD) for Overall Sample and Subsamples of Children with and without ADHD, plus *t*-test Results Comparing Subsamples

Variable	Overall	ADHD	Control	*t*
Attention to Traffic	33.81 (7.36)	32.98 (7.51)	34.66 (7.20)	1.00
NEPSY Visual Attention	9.22 (3.08)	8.38 (3.44)	10.09 (2.43)	2.34*

* $p < .05$

Table 2. Linear Regression: ADHD Status Predicting Attention to Traffic

	B	SE	β
ADHD Status	-1.68	1.68	-0.12

Table 3. Linear Regression: NEPSY Visual Attention Score Predicting Attention to Traffic

	B	SE	β
Visual Attention	0.59	0.27	0.25*

* $p < .05$

Table 4. Linear Regression: ADHD Status and NEPSY Visual Attention Score Predicting Attention to Traffic

	B	SE	β
ADHD Status	0.56	0.28	0.23*
Visual Attention	-0.88	1.72	-0.06

* $p < .05$

Conclusion

Researchers and interventionists should consider the role visual attention plays in pediatric pedestrian safety. These findings suggest that neuropsychological testing using an instrument like the NEPSY, but not a diagnosis of ADHD, is a significant predictor of visual attention in a pedestrian environment. Such neuropsychological measures could be easily utilized to test children for potentially dangerous pedestrian behaviors. Researchers, educators, parents, and interventionists should continue to investigate strategies that might reduce pedestrian injury risk, and these results suggest that something as simple as a visual attention test might predict one aspect of pedestrian safety, visual attention to traffic.

References

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