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ORIGINAL ARTICLE

Relation between internalizing behaviors, externalizing behaviors, and peer victimization among children with and without ADHD

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Abstract
The current study explored the concurrent and longitudinal association between internalizing behaviors, externalizing behaviors, and peer victimization among children with and without ADHD. Eighty children (42 ADHD, 38 non-ADHD) ages 8–12 participated in the present study conducted over a 6-month period. During the baseline session, parents completed a structured diagnostic interview and the Vanderbilt ADHD Parent Rating Scale to determine whether their child met criteria for ADHD, and the Child Behavior Checklist (CBCL) to assess their child's internalizing and externalizing behaviors; children completed the Perception of Peer Support Scale (PPSS) to assess experiences of peer victimization. At the 6-month follow-up session, parents completed the CBCL and children completed the PPSS. Concurrently, internalizing behaviors were associated with peer victimization among children with and without ADHD; ADHD moderated this relation, such that internalizing behaviors were more strongly related to peer victimization among children with ADHD. Longitudinally, internalizing behaviors at baseline predicted peer victimization at 6-month follow-up; however, further analyses demonstrated there was a covarying change in internalizing behaviors and peer victimization. These findings suggest internalizing behaviors are related to peer victimization concurrently, and over time, and are associated with increased risk for peer victimization in the presence of ADHD. Additionally, internalizing behaviors and peer victimization appear to share a dynamic relationship; that is, decreases in internalizing behaviors predict similar decreases in peer victimization. No significant relations were observed between externalizing behaviors and peer victimization. Implications and limitations are discussed.

Keywords ADHD · Peer victimization · Internalizing behaviors · Externalizing behaviors

Introduction

Peer victimization

Characterized as a broad spectrum of social interactions whereby one individual experiences physical, emotional, social or psychological harm by one or more peers (Rosen et al. 2009), peer victimization affects many children (Kochenderfer-Ladd and Ladd 2001) across all ethnic (Craig et al. 2009) and socioeconomic backgrounds (Card and Hodges 2008). Most frequent during early adolescence (see Troop-Gordon 2017 for review), peer victimization often occurs outside of school contexts (Turner et al. 2011) and becomes stable over time (Scholte et al. 2007). Peer victimization includes overt and relational forms of victimization (Crick and Grotpeter 1995, 1996), and children who are victimized are categorized as aggressive or passive victims (Olweus 1994). While general rates of peer victimization appear to similarly affect males and females (Kochenderfer-Ladd and Skinner 2002), males are more likely to experience overt victimization and females are more likely to experience relational victimization (Betts et al. 2015; Crick et al. 2002; Crick and Nelson 2002); both overt and relational forms of victimization are associated with concurrent socioemotional adjustment problems (Crick and Bigbee 1998).

Peer victimization is an antecedent to (Bond et al. 2001; Gladstone et al. 2006), and consequence of (Reijntjes et al. 2010), poor emotional functioning. Prior studies suggest children who fail to manage their emotions may experience a greater frequency of victimization (Rosen et al. 2012), and peer victimization may impair a child's ability to regulate their emotions (Stadler et al. 2010). Given evidence that

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internalizing and externalizing behaviors are behavioral expressions of deficits in emotion regulation (Zeman et al. 2002), internalizing and externalizing behaviors may play an important role in peer victimization among children. Indeed, peer victimization has been shown to be both a risk factor for (Reijntjes et al. 2010, 2011) and consequence associated with internalizing and externalizing behaviors (Hodges et al. 1999; Storch and Ledley 2005).

Peer victimization and internalizing behaviors

Internalizing behaviors include depression, anxiety, withdrawal, and loneliness, and have been shown to be relatively stable throughout childhood with slight increases during adolescence (Twenge and Nolen-Hoeksema 2002). In cross-sectional studies, there is a strong association between internalizing behaviors and peer victimization (Hawker and Boulton 2000; Juvonen et al. 2003), as anxiety (Kumpulainen et al. 1998) and depression (Kaltiala-Heino et al. 1999) have been shown to be associated with increased rates of peer victimization. Longitudinally, research consistently demonstrates a bi-directional relation between internalizing behaviors and peer victimization; internalizing behaviors lead to greater frequency of peer victimization experiences (Storch et al. 2005; Fekkes et al. 2006), and peer victimization predicts differing aspects of internalizing behaviors (Boivin et al. 1995; Crick and Bigbee 1998; Olweus 1993; Reijntjes et al. 2010). In a study conducted by Hodges and Perry (1999), internalizing behaviors led to greater peer victimization over time, while initial levels of peer victimization simultaneously predicted increases in internalizing behaviors. Children with internalizing behaviors may be less likely to effectively assert and defend themselves in social situations, and attempts to resolve peer conflict may prove ineffective and lead to experiences of peer victimization (Kochenderfer-Ladd and Skinner 2002). The experience of peer victimization is particularly distressing (Ybarra et al. 2006) and may interfere with a child's ability to manage negative emotions and execute effective coping techniques. This may ultimately affect child's ability to manage internalizing behaviors and further increase their risk for victimization by peers.

Peer victimization and externalizing behaviors

Externalizing behaviors include aggression, disruption, and opposition/defiance, and are strongly associated with peer victimization (Hanish and Guerra 2002; Sullivan et al. 2006). As observed with internalizing behaviors, externalizing behaviors may serve as both a predictor and an outcome of peer victimization (Reijntjes et al. 2011). Hodges, Boivin, Vitaro, and Bukowski (1999) found that externalizing behaviors predicted peer victimization, and Hanish and Guerra (2002) demonstrated that peer victimization predicted increases in externalizing behaviors. Children with externalizing behaviors may fail to appropriately manage peer conflict because they may be more likely to respond to peer provocation through aggression; this likely increases their risk for subsequent victimization (Perry et al. 1990). Additionally, the experience of peer victimization may lead to greater externalizing behaviors as children who experience peer victimization may be more likely to direct feelings of negative emotions outward and demonstrate negative emotions in the presence of others.

Neurodevelopmental disorders such as attention-deficit/hyperactivity disorder (ADHD) have long been associated with increased rates of internalizing and externalizing behaviors (August et al. 1996; Edelbrock et al. 1984; Eiraldi et al. 1997). Children with ADHD are rated by their parents and teachers as demonstrating more frequent internalizing behaviors (Eiraldi et al. 1997), and research suggests a strong relation between ADHD and increased demonstration of externalizing behaviors (August et al. 1996; Edelbrock et al. 1984). Given that internalizing and externalizing behaviors have each been uniquely identified as a predictor and outcome of peer victimization, children with ADHD may suffer from higher rates of victimization due to demonstrating a greater frequency of internalizing and externalizing behaviors.

Peer victimization and ADHD

ADHD is mainly characterized by symptoms of inattention, impulsivity, and hyperactivity (American Psychiatric Association 2013). Affecting nearly five percent of children worldwide (Polanczyk et al. 2007), children with ADHD are more likely to demonstrate emotional and behavioral difficulties (Rosen and Factor 2015; Rosen et al. 2015), and problems with social functioning (Biederman et al. 1993; Cantwell 1996). Research suggests that children with ADHD often have fewer friends and are less well-liked relative to unaffected peers (Hoza et al. 2005) and experience higher rates of peer victimization (Unnever and Cornell 2003; Wiener and Mak 2009). Fogleman, Walerius, Rosen and Leaberry (2016) demonstrated that children with ADHD may experience higher rates of peer victimization due to their inability to manage negative emotions, and Humphrey, Storch and Geffken (2007) found that peer victimization among children with ADHD is associated with internalizing and externalizing behaviors.

Children with ADHD often demonstrate an inability to regulate emotions and react impulsively to negative situations (Barkley 2014). Given the high rates of internalizing and externalizing behaviors in children with ADHD (Edelbrock et al. 1984; Eiraldi et al. 1997), and the high correspondence between internalizing behaviors, externalizing

behaviors, and peer victimization, it is likely that internalizing and externalizing behaviors differentially affect peer victimization among children with and without ADHD. Children with ADHD may experience higher rates of peer victimization because they are more likely to act on negative emotions and demonstrate increased internalizing and externalizing behaviors in the presence of peers.

Research questions

The current study explored the concurrent and longitudinal association between internalizing behaviors, externalizing behaviors, and peer victimization among children with and without ADHD. The following hypotheses were posited:

1. ADHD, internalizing behaviors, and externalizing behaviors will all be associated with concurrent peer victimization.
2. ADHD, internalizing behaviors, and externalizing behaviors at baseline will each predict peer victimization at 6-month follow-up.
3. ADHD and peer victimization at baseline will each predict internalizing and externalizing behaviors at 6-month follow-up.
4. Concurrent and predictive effects of internalizing behaviors and externalizing behaviors on peer victimization will be moderated by ADHD, such that children with higher levels of internalizing and externalizing behaviors will be at the greatest risk for peer victimization in the presence of ADHD.

Methods

Participants

Eighty children ages 8–12 and their families participated in the present study. Participants in the current study included 42 children with ADHD (28 boys, 14 girls; *M* age = 9.62 ± 1.23) and 38 children without ADHD (19 boys, 19 girls; *M* age = 9.97 ± 1.24; Table 1). Of the 80 children who enrolled in the study, 62 children returned for a follow-up session 6 months after the initial baseline session. Participants who completed the follow-up session included 31 children with ADHD (23 boys, 8 girls; *M* age = 9.65 ± 1.23) and 31 children without ADHD (17 boys, 14 girls; *M* age = 10.00 ± 1.18).

Children were recruited through advertisements distributed through local schools in a mid-sized Midwestern metropolitan area. The Diagnostic Structured Interview for Children Parent Report (DISC-P; Shaffer et al. 2000) and the Vanderbilt ADHD Parent Rating Scales (VAPRS; Wolraich et al. 2003) were used to assess ADHD diagnostic status. Children who were categorized as having ADHD met criteria on both the DISC-P and the VAPRS. Within the ADHD group, 32 children met full diagnostic criteria for combined type and 10 children met full diagnostic criteria for inattentive type. The ADHD module of the DISC-P (Shaffer et al. 2000) contains a question related to current use of psychotropic medications to treat ADHD (stimulant and non-stimulant). This question was used to assess active ADHD medication usage. Twenty-five of 42 children with ADHD were receiving medication treatment at baseline.

Children without ADHD represented a community sample rather than a healthy control sample; thus, children were not excluded from the study if they had symptoms of ADHD but did not meet criteria for diagnosis. Children in the non-ADHD group ranged from 0 to 5 total symptoms of inattention (*M* = 1.33 ± 1.60) and hyperactivity/impulsivity (*M* = .69 ± 1.28). To ensure that the non-ADHD sample represented a true community sample, children in the non-ADHD group were included in the study regardless of the presence of disorders other than ADHD.

The ethnic composition of the sample was reflective of the area from which the population was collected (United States Census Bureau 2010) with 67.5% of the children

Table 1 Demographics for ADHD and non-ADHD diagnostic groups at baseline and follow-up

Measure	Baseline		Follow-up	
Diagnostic status	ADHD	Non-ADHD	ADHD	Non-ADHD
Age: years	9.62 ± 1.23	9.97 ± 1.24	9.65 ± 1.23	10.00 ± 1.18
Sex (M)	28 (66.7%)	19 (50.0%)	23 (74.0%)	17 (54.8%)
Race/ethnicity				
Caucasian/White	26 (61.9%)	28 (73.7%)	20 (64.5%)	23 (74.2%)
African American/Black	13 (31.0%)	7 (18.4%)	9 (29.0%)	5 (16.1%)
Latino/Hispanic	3 (7.1%)	0 (.0%)	2 (6.5%)	0 (.0%)
Pacific Islander/Asian	0 (.0%)	1 (2.6%	0 (.0%)	1 (3.2%)
Biracial	0 (.0%)	2 (5.3%)	0 (.0%)	2 (6.5%)

Baseline, *N* = 80, ADHD *N* = 42, non-ADHD *N* = 38; follow-up, *N* = 62, ADHD *N* = 31, non-ADHD = 31

described as Non-Hispanic White/Caucasian, 25.0% of the children described as Non-Hispanic Black/African American, 3.8% of the sample described as Hispanic/Latino, 2.5% of the sample described as having more than one racial/ethnic background, and 1.3% described as Asian/Pacific Islander.

Procedures

This study was conducted as part of a larger study examining children's emotions; therefore, only procedures relevant to the current study are outlined. Informed consent was obtained from all participants included in the study. During the baseline session, parents completed a structured diagnostic interview (DISC-P; Shaffer et al. 2000) and the Vanderbilt ADHD Parent Rating Scale (VAPRS; Wolraich et al. 2003) to determine whether their child met criteria for ADHD, and the Child Behavior Checklist (CBCL; Achenbach and Rescorla 2001) to assess for the presence of internalizing and externalizing behaviors in children. Additionally, during the baseline session, children completed the Perception of Peer Support Scale (PPSS; Ladd et al. 1996) to assess the frequency of peer victimization experiences. At the 6-month follow-up session, parents completed the CBCL and children completed the PPSS. Means for all measures are provided in Table 2. Parents and children each received compensation for completing baseline and follow-up sessions.

Measures

The *Diagnostic Structured Interview for Children-Version IV, Parent Report (DISC-P;* Shaffer et al. 2000) was used to provide diagnostic assessment of ADHD in children. The DISC-P is a diagnostic structured interview that provides a reliable means of assessing for the presence of ADHD in children (Shaffer et al. 2000).

The *Vanderbilt ADHD Parent Rating Scale* (VAPRS; Wolraich et al. 2003) was also used as a diagnostic assessment of ADHD in children. The first 18 items comprise the ADHD subscale and include items assessing for ADHD inattentive symptoms and ADHD hyperactive/impulsive symptoms. Parents are asked to rate their child on a four-point Likert scale ("Never," "Occasionally," "Often," and "Very Often"). Symptoms are considered 'present' if they are rated as "Often" or "Very Often". Previous research supports the reliability and validity of the ADHD subscales of the VADPRS (Wolraich et al. 2003).

The *Child Behavior Checklist* (CBCL; Achenbach and Rescorla 2001) was used to assess children's internalizing and externalizing behavior. The CBCL is a measure of parents' perceptions of their children's social and behavioral competencies and problems (Achenbach and Rescorla 2001). Parents rated their children on 112 problem behaviors on a three-point Likert scale ("Not True," "Somewhat or Sometimes True," and "Very True or Often True"). Ratings produce indices of externalizing behavior, internalizing behavior and total problems, as well as age- and reporter-relevant subscales. Internalizing behavior was derived from the sum of 32 items from three scales (i.e., Withdrawn/Depressed, Somatic Complaints, and Anxious/Depressed), and externalizing behavior was derived from the sum of 35 items from two scales (i.e., Rule-Breaking Behavior and Aggressive Behavior). Overall internalizing and externalizing behaviors were determined by the CBCL Internalizing scale (CBCL-Internalizing) and the CBCL Externalizing scale (CBCL-Externalizing) T-scores. The CBCL has demonstrated reliability and validity in both clinical and non-clinical populations and across cultures (Koot and Verhulst 1992). Furthermore, the CBCL demonstrated good to excellent internal consistency in this study for both internalizing (alpha: baseline = .88; follow-up = .89) and externalizing scales (alpha: baseline = .93; follow-up = .89).

The *Perception of Peer Support Scale* (PPSS; Ladd et al. 1996) was used to assess peer victimization. The PPSS is a 12-item child-report measure designed to assess a child's overt and relational peer victimization experiences (Ladd et al. 1996). Studies have suggested that child-report of peer victimization contributes valid and unique variance to the estimation of peer victimization in middle childhood (Ladd

Table 2 Mean scores of PPSS, CBCL-Internalizing, and CBCL-Externalizing for children with and without ADHD at baseline and follow-up

Measure	Baseline		*p*	Follow-up		*p*
Diagnostic status	ADHD	Non-ADHD		ADHD	Non-ADHD	
PPSS	1.54	1.41	.26	1.33	1.37	.75
CBCL-Internalizing	63.05	53.89	< .001	59.35	50.61	.002
CBCL-Externalizing	63.88	48.28	< .001	58.71	47.83	< .001

Baseline, $N = 80$, ADHD $N = 42$, Non-ADHD $N = 38$; Follow-up, $N = 62$, ADHD $N = 31$, Non-ADHD = 31. At baseline and follow-up, significant differences were observed for CBCL-Internalizing (baseline: F (1, 79) = 17.67, $p < .001$; follow-up: F (1, 61) = 10.72, $p = .002$) and CBCL-Externalizing (baseline: F (1, 79) = 48.50, $p < .001$; follow-up: F (1, 61) = 22.18, $p < .001$) between children with and without ADHD. No significant differences were observed for PPSS (baseline: F (1, 79) = 1.27, $p = .26$; follow-up: F (1, 61) = .10, $p = .75$) between children with and without ADHD

and Kochenderfer-Ladd 2002). Child-report measures of victimization were selected for the current study to allow for the comparison of parent-observed internalizing and externalizing behaviors to child-report of peer victimization experiences, and to reduce shared-rater variance (Hawker and Boulton 2000). The PPSS child-report scale demonstrated good to excellent internal consistency in this study (alpha: baseline = .92; follow-up = .87).

Statistical analyses

To determine if the 6-month follow-up sample was representative of the baseline sample, one-way ANOVAs were calculated for all demographic, independent and dependent variables. Bivariate correlations were conducted to assess patterns of relations among baseline and follow-up measures. Multivariate hierarchical linear regression analyses were conducted to examine the effect of CBCL-Internalizing, CBCL-Externalizing, and ADHD on baseline PPSS and follow-up PPSS, and to examine the effect of PPSS and ADHD on follow-up CBCL-Internalizing and CBCL-Externalizing.

To assess hypothesis 1, PPSS was regressed on ADHD, CBCL-Internalizing and CBCL-Externalizing. Age, sex, and active ADHD medication use were entered into the first step. ADHD was entered into the second step to assess whether there was a main effect of ADHD in the estimation of PPSS when controlling for age, sex, and active ADHD medication use. CBCL-Internalizing and CBCL-Externalizing were entered into the third step to assess whether there was a main effect of CBCL-Internalizing and CBCL-Externalizing above and beyond the impact of ADHD in the estimation of PPSS when controlling for age, sex, and active medication use. ADHD by CBCL-Internalizing interaction and ADHD by CBCL-Externalizing interaction terms were entered in the fourth step to assess whether or not ADHD moderated the effect of CBCL-Internalizing or CBCL-Externalizing in the estimation of peer victimization.

To assess hypothesis 2, follow-up PPSS was regressed on ADHD, CBCL-Internalizing and CBCL-Externalizing. Age, sex, active ADHD medications and PPSS were entered into the first step. ADHD was entered into the second step to assess whether there was a main effect of ADHD in the estimation of follow-up PPSS above and beyond the impact of baseline PPSS when controlling for age, sex, and active ADHD medications. CBCL-Internalizing and CBCL-Externalizing were entered into the third step to assess whether there was a main effect of CBCL-Internalizing and CBCL-Externalizing in the estimation of follow-up PPSS above and beyond the effects of baseline PPSS and ADHD. An ADHD by CBCL-Internalizing interaction and an ADHD by CBCL-Externalizing interaction were entered in the fourth step to assess whether or not ADHD moderated the effect of CBCL-Internalizing or CBCL-Externalizing in the estimation of follow-up PPSS.

To assess hypothesis 3, follow-up CBCL-Internalizing and follow-up CBCL-Externalizing were each independently regressed on ADHD and PPSS. Age, sex, active ADHD medications and CBCL-Internalizing/CBCL-Externalizing were entered into the first step. ADHD was entered in the second step to assess whether there was a main effect of ADHD in the estimation of follow-up CBCL-Internalizing/follow-up CBCL-Externalizing above and beyond the impact of baseline CBCL-Internalizing/CBCL-Externalizing when controlling for age, sex, and active ADHD medication. PPSS was entered into the third step to assess whether there was a main effect of PPSS in the estimation of follow-up CBCL-Internalizing/follow-up CBCL-Externalizing above and beyond the effects of baseline CBCL-Internalizing/baseline CBCL-Externalizing and ADHD.

Following a priori analyses, alternative model testing was used to ensure that data weren't better fit by an alternative model. In all analyses, Akaike information criteria (AIC) was used to assess model fit, with ΔAIC signifying the difference between the AIC with the inclusion of ADHD and the next best fitting model. Negative ΔAIC scores indicated lower AIC and thus improved fit for the inclusion of the main effects and/or the interaction term in the overall model. All data were analyzed using SPSS® 24 software (Armonk, NY).

Results

Attrition analyses

Of the 80 children who enrolled in the study, 62 children (77.5%) completed the follow-up measure of the PPSS. No significant differences were observed for age (F (1,79) = .22, p = .64), ADHD (F (1,79) = .68, p = .41), ADHD medications (F (1,79) = .05, p = .83), PPSS (F (1,79) = .02, p = .89), and CBCL-Internalizing (F (1,79) = 1.18, p = .28). Significant differences were observed for sex (F(1,79) = 3.87, p = .05) and CBCL-Externalizing (F(1,79) = 4.53, p = .04), such that children who returned for follow-up visits 6 months were more likely to be male and demonstrate fewer amounts of externalizing behaviors.

Bivariate analyses

Significant correlations were observed between ADHD and CBCL-Internalizing (r[80] = .43, p < .001), CBCL-Externalizing (r[80] = .62, p < .001), follow-up CBCL-Internalizing (r[62] = .39, p = .002) and follow-up CBCL-Externalizing (r[62] = .52, p < .001) indicating that ADHD was associated with significantly greater internalizing and

externalizing behaviors across baseline and follow-up sessions (Table 3). The relation between CBCL-Internalizing and PPSS was also significant ($r[80] = .27$, $p = .02$), suggesting that internalizing behaviors were significantly associated with greater peer victimization at baseline. ADHD was not significantly associated with PPSS ($r[80] = .13$, $p = .26$) or follow-up PPSS ($r[62] = -.04$, $p = .75$).

Relation of ADHD, internalizing behaviors, and externalizing behaviors to concurrent peer victimization

Results partially supported hypothesis 1: ADHD, internalizing behaviors, and externalizing behaviors will all be associated with concurrent peer victimization. Internalizing behaviors, not externalizing behaviors or ADHD, were significantly associated with concurrent peer victimization (Table 4). Examination of the covariates entered into the first step suggested that they did not contribute significantly to model fit for PPSS ($\Delta R^2 = .05$ $p = .26$, AIC = − 98.19). Step two of the model indicated that ADHD did not contribute significant variance to the estimation of PPSS ($\Delta R^2 = .00$, $p = .74$, AIC = − 96.31, ΔAIC = 1.88). Step three of the model indicated that CBCL-Internalizing and CBCL-Externalizing contributed significant variance to the estimation of PPSS ($\Delta R^2 = .08$, $p = .04$, AIC = − 99.22, ΔAIC = − 2.91). Specifically, children who had greater CBCL-Internalizing scores had higher ratings on the PPSS ($\beta = .34$, $t = 2.25$, $p = .03$); CBCL-Externalizing was not uniquely associated with peer victimization ($\beta = -.05$, $t = -.26$, $p = .80$). Step four of the model suggested that the effect of CBCL-Internalizing on the estimation of PPSS was moderated by ADHD ($\Delta R^2 = .13$, $p = .003$, AIC = − 108.23, ΔAIC = − 9.01), such that CBCL-Internalizing was more strongly related to PPSS in children with ADHD rather than children without ADHD ($\beta = .62$, $t = 3.50$, $p = .001$; Fig. 1). Results supported the overall model with interaction included ($R^2 = .26$, $F(8, 79) = 3.15$, $p = .004$).

Table 3 Summary of bivariate correlations

Measure	1	2	3	4	5	6
1. ADHD	–					
2. PPSS	.13	–				
3. CBCL-Internalizing	.43†	.27*	–			
4. CBCL-Externalizing	.62†	.16	.67†	–		
5. Follow-up PPSS	− .04	.50†	− .04	.07	–	
6. Follow-up CBCL-Internalizing	.39§	.11	.76†	.53†	.04	–
7. Follow-up CBCL-Externalizing	.52†	.24	.69†	.83†	.14	.63†

$N = 80$ for ADHD, PPSS, CBCL-Internalizing and CBCL-Externalizing; $N = 62$ for follow-up PPSS, follow-up CBCL-Internalizing and follow-up CBCL-Externalizing

*$p < .05$; §$p < .01$; †$p < .001$

Table 4 Relation of CBCL-Internalizing and CBCL-Externalizing to PPSS

Step/variable	*B*	*SE B*	*t*	*β*	R^2	ΔR^2	*AIC*
Step 1					.05	.05	− 98.19
Sex (male = 0, female = 1)	.14	.12	1.13	.13			
Age	− .06	.05	− 1.14	− .13			
Stimulant medication use (no = 0, yes = 1)	.18	.13	1.40	.16			
Step 2					.05	.00	− 96.31
ADHD (Non-ADHD = 0, ADHD = 1)	.05	.16	.33	.05			
Step 3					.13	.08	− 99.22
CBCL-Internalizing	.02	.01	2.25*	.34			
CBCL-Externalizing	− .00	.01	− .26	− .05			
Step 4					.26	.13	− 108.23
CBCL-Internalizing × ADHD	.05	.01	3.50§	.62			

$N = 80$

*$p < .05$; §$p < .01$

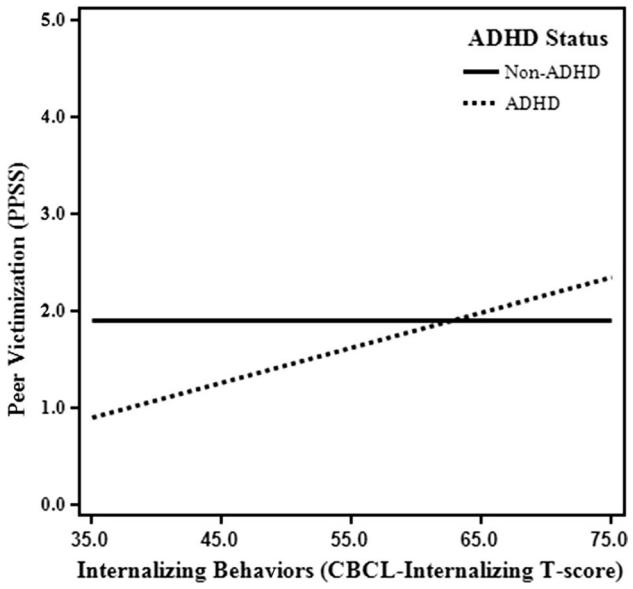

Fig. 1 Relation of Internalizing Behaviors and Peer Victimization Moderated by ADHD. Internalizing behaviors on the estimation of peer victimization was moderated by ADHD ($\beta = .62$, $t = 3.50$, $p = .001$), such that internalizing behaviors were more strongly related to peer victimization in children with ADHD rather than children without ADHD

Relation of ADHD, internalizing behaviors, and externalizing behaviors to follow-up peer victimization

Results partially supported hypothesis 2: ADHD, internalizing behaviors, and externalizing behaviors at baseline will each predict peer victimization at 6-month follow-up. Internalizing behaviors, not externalizing behaviors or ADHD, predicted follow-up peer victimization (Table 5). Covariates entered into the first step contributed significantly to model fit for follow-up PPSS ($\Delta R^2 = .28$, $p = .001$, AIC = − 126.07). Specifically, PPSS positively predicted follow-up PPSS ($\beta = .53$, $t = 4.61$, $p < .001$); children who reported greater peer victimization at baseline were significantly more likely to report peer victimization at follow-up. In the second step, results did not indicate a significant main effect of ADHD in the prediction of follow-up PPSS ($\Delta R^2 = .02$, $p = .23$, AIC = − 125.68, ΔAIC = − .39). Step three of the model indicated that CBCL-Internalizing and CBCL-Externalizing did not contribute significant variance to the prediction of follow-up PPSS ($\Delta R^2 = .07$, $p = .06$, AIC = − 128.00, ΔAIC = − 2.32); however, CBCL-Internalizing scores negatively predicted follow-up PPSS ($\beta = -.39$, $t = -2.41$, $p = .02$). Children with greater internalizing behaviors at baseline were less likely to report peer victimization at follow-up relative to their reports of peer victimization at baseline. CBCL-Externalizing was not predictive of follow-up PPSS ($\beta = .25$, $t = 1.34$, $p = .19$). Step four of the model suggested that the effect of CBCL-Internalizing on the estimation of follow-up PPSS was not moderated by ADHD ($\Delta R^2 = .00$, $p = .88$, AIC = − 124.30, ΔAIC = 3.70), suggesting that the model was best fit by a main effect of CBCL-Internalizing on follow-up PPSS ($R^2 = .37$, $F(7, 61) = 4.42$, $p = .001$).

Relation of ADHD and peer victimization to follow-up internalizing behaviors and externalizing behaviors

Results did not support hypothesis 3: ADHD and peer victimization at baseline will each predict internalizing and externalizing behaviors at 6-month follow-up. ADHD and peer victimization did not predict either internalizing or externalizing behaviors at follow-up. For follow-up CBCL-Internalizing, covariates entered into the first

Table 5 Relation of CBCL-Internalizing and CBCL-Externalizing to follow-up PPSS

Step/variable	*B*	*SE B*	*t*	*β*	R^2	ΔR^2	*AIC*
Step 1					.28	.28	− 126.07
Sex (male = 0, female = 1)	− .13	.10	− 1.35	− .16			
Age	.03	.04	.84	.10			
Stimulant medication use (no = 0, yes = 1)	− .02	.09	− .18	− .02			
PPSS	.40	.09	4.61†	.53			
Step 2					.30	.02	− 125.68
ADHD (Non-ADHD = 0, ADHD = 1)	− .14	.11	− 1.21	− .18			
Step 3					.36	.07	− 128.00
CBCL-Internalizing	− .01	.01	− 2.41*	− .39			
CBCL-Externalizing	.01	.01	1.34	.25			
Step 4					.37	.00	− 124.30
CBCL-Internalizing × ADHD	− .00	.01	.03	.01			

$N = 62$

*$p < .05$; †$p < .001$

step contributed significantly to the model fit ($\Delta R^2 = .60$, $p < .001$, AIC = 250.21). CBCL-Internalizing positively predicted follow-up CBCL-Internalizing ($\beta = .74$, $t = 7.92$, $p < .001$); children who reported greater internalizing behaviors at baseline were significantly more likely to report internalizing behaviors at follow-up. In the second step, results did not indicate a significant main effect of ADHD in the prediction of follow-up CBCL-Internalizing ($\Delta R^2 = .00$, $p = .98$, AIC = 252.21, ΔAIC = 2.00). Step three of the model indicated that PPSS did not contribute to the prediction of follow-up CBCL-Internalizing ($\Delta R^2 = .01$, $p = .23$, AIC = 252.52, ΔAIC = .31).

For follow-up CBCL-Externalizing, covariates entered into the first step contributed significantly to the model fit ($\Delta R^2 = .70$, $p = .001$, AIC = 224.22). CBCL-Externalizing positively predicted follow-up CBCL-Externalizing ($\beta = .81$, $t = 9.22$, $p < .001$); children who reported greater externalizing behaviors at baseline were significantly more likely to report externalizing behaviors at follow-up. In the second step, results did not indicate a significant main effect of ADHD in the prediction of follow-up CBCL-Externalizing ($\Delta R^2 = .00$, $p = .81$, AIC = 226.16, ΔAIC = 1.94). Step three of the model indicated that PPSS did not contribute to the prediction of follow-up CBCL-Externalizing ($\Delta R^2 = .01$, $p = .30$, AIC = 226.95, ΔAIC = .79).

Alternative model testing

Relation of change between internalizing behaviors and peer victimization

Initial results from follow-up analyses suggested that internalizing behaviors at baseline negatively predicted follow-up peer victimization after the prediction associated with concurrent peer victimization was statistically controlled. These results indicated that children with higher rates of internalizing problems at baseline reported significantly less peer victimization at follow-up relative to their peer victimization at baseline. Given the findings are incongruent with current literature (Reijntjes et al. 2010; Storch et al. 2005), alternative model testing examined how internalizing behaviors and peer victimization variables covaried over time. To assess this relation, change scores were calculated for internalizing behaviors (chCBCL-Internalizing), externalizing behaviors (chCBCL-Externalizing), and peer victimization (chPPSS) from baseline to 6-month follow-up. Multivariate hierarchical linear regression analyses were conducted to examine the effect of chCBCL-Internalizing and chCBCL-Externalizing on chPPSS.

Results suggested that chCBCL-Internalizing was associated with chPPSS (Table 6). Specifically, chCBCL-Internalizing scores were positively associated with chPPSS ($\beta = .23$, $t = 2.26$, $p = .03$), suggesting that after controlling for age, sex, ADHD medications, PPSS and ADHD, changes in internalizing behaviors from baseline to 6-month follow-up significantly predicted changes in peer victimization from baseline to 6-month follow-up. This suggests a covarying change in internalizing behaviors and peer victimization; reductions in internalizing behaviors over the 6-month study interval were accompanied by corresponding reductions in peer victimization. No associations between changes in externalizing behaviors and peer victimization were observed ($\beta = -.07$, $t = -.65$, $p = .52$).

Table 6 Relation of CBCL-Internalizing and CBCL-Externalizing change scores to PPSS change scores

Step/variable	*B*	*SE B*	*t*	*β*	R^2	ΔR^2	*AIC*
Step 1					.53	.53	− 126.54
Sex (male = 0, female = 1)	− .14	.09	− 1.46	− .14			
Age	.02	.04	.66	.06			
Stimulant medication use (no = 0, yes = 1)	.18	.11	1.61	.15			
PPSS	− .64	.09	− 7.37†	− .71			
Step 2					.54	.01	− 125.60
ADHD (Non-ADHD = 0, ADHD = 1)	− .09	.09	− .98	− .09			
Step 3					.58	.04	− 127.23
chCBCL-Internalizing	.01	.01	2.26*	.23			
chCBCL-Externalizing	− .01	.01	− .66	− .07			
Step 4					.59	.01	− 123.96
chCBCL-Internalizing × ADHD	− .01	.01	− .76	− .10			

$N = 62$

*$p < .05$; †$p < .001$

Discussion

Findings from the current study reinforce previous studies suggesting children with ADHD demonstrate increased rates of internalizing and externalizing behaviors relative to unaffected children (August et al. 1996; Eiraldi et al. 1997). Consistent with study hypotheses, internalizing behaviors were linked to concurrent peer victimization and were moderated by ADHD, such that internalizing behaviors were more strongly related to peer victimization in the presence of ADHD. Additionally, internalizing behaviors predicted peer victimization in children with and without ADHD at 6-month follow-up. However, the direction of this prediction was inconsistent with both study hypotheses and previously documented findings (Reijntjes et al. 2010; Storch et al. 2005). Further analyses revealed that changes in internalizing behaviors from baseline to 6-month follow-up predicted changes in peer victimization from baseline to 6-month follow-up. These findings suggest that internalizing behaviors covary with, and are dynamically related to, peer victimization; decreases in internalizing behaviors are associated with corresponding decreases in peer victimization. Results did not support theoretical hypotheses that ADHD and externalizing behaviors would be associated with concurrent or future peer victimization, and changes in externalizing behaviors were not associated with changes in peer victimization. Furthermore, ADHD and peer victimization did not predict internalizing or externalizing behaviors at 6-month follow-up.

Theoretical implications

Findings of the current study are consistent with previous literature suggesting that internalizing behaviors are uniquely related to concurrent peer victimization (Hawker and Boulton 2000; Juvonen et al. 2003), but are incongruent with research suggesting that internalizing behaviors predict greater peer victimization experiences over time (Storch et al. 2005; Reijntjes et al. 2010; Fekkes et al. 2006). Internalizing behaviors describe a specific pattern of emotion dysregulation that is characterized by failing to effectively manage and cope with feelings of negative emotions. Children who demonstrate internalizing behaviors may be more likely to experience higher rates of concurrent victimization because they fail to manage negative emotions and emotionally react to stressful social situations, impairing the use of effective conflict resolution skills and rewarding those picking on them. Additionally, children with internalizing behaviors may be more likely to be victimized because they demonstrate greater amounts of negative emotions. Prior literature suggests children prefer friends who express fewer negative emotions (Hay et al. 2004), and children who regulate their emotions are seen as more socially competent than those who do not (Hubbard and Coie 1994). Thus, children who fail to regulate their emotions and express internalizing behaviors may be less likely to form high-quality friendships which may protect them from experiencing peer victimization (Bollmer et al. 2005; Hodges et al. 1999).

ADHD was unrelated to peer victimization. This finding is inconsistent with previous studies (Unnever and Cornell 2003; Wiener and Mak 2009); however, the current study employed the use of a child-report measure of peer victimization. The finding that ADHD was not associated with peer victimization may be partially explained by the positive illusory bias, a well-documented finding regarding the social self-perceptions of children with ADHD (Hoza et al. 2004). The positive illusory bias is defined as the disparity between the self-perceptions of competence and actual competence (Hoza et al. 1993) and children with ADHD have been shown to be poor monitors of their social functioning; that is, they often overestimate their social competence (Hoza et al. 2004). Given the well-established findings of the positive illusory bias in children with ADHD, the lack of relation of ADHD to child-report of peer victimization may have been due to inflated self-perceptions of children with ADHD. Further studies may seek to explore whether the positive illusory bias extends to peer victimization.

While ADHD was not directly linked to peer victimization, the relation of internalizing behaviors to concurrent peer victimization was moderated by ADHD, such that children with greater levels of internalizing behaviors were more likely to report peer victimization if they had also been diagnosed with ADHD. The presence of internalizing behaviors among children with ADHD may differentially affect the frequency in which a child experiences peer victimization, and is consistent with previous literature suggesting internalizing behaviors were associated with greater peer victimization among children with ADHD (Humphrey et al. 2007). Internalizing behaviors among children with ADHD may suppress the positive illusory bias (Hoza et al. 2004) and influence the accuracy in which they make inferences (Alloy and Abramson 1988). Thus, children with ADHD and internalizing behaviors may be more accurate reporters of their peer victimization experiences. However, given that internalizing behaviors (Reijntjes et al. 2010) and ADHD (Cantwell 1996; Biederman et al. 1993) are independently associated with deficits in social functioning, it also may be the case that peer victimization happens more frequently to children with ADHD and co-occurring internalizing behaviors.

Longitudinal findings suggest that there was a covarying change in internalizing behaviors and peer victimization;

reductions in internalizing behaviors over the 6-month duration of the study were accompanied by corresponding reductions in peer victimization experiences. Although Hodges and Perry (1999) and Reijntjes et al. (2010) demonstrated that internalizing behaviors function as both a predictor and an outcome of peer victimization, the current study suggests that internalizing behaviors and peer victimization may be dynamically related, such that the degree of internalizing behaviors directly predicts the frequency of peer victimization experiences. For a child with greater internalizing behaviors, experiences of victimization may be due to an inability to effectively cope and manage negative emotions; however, for a child with fewer internalizing behaviors, the ability to properly cope and manage negative emotions may prevent episodes of peer conflict and victimization. While unexpected, this is the first longitudinal study to date—to the authors' knowledge—to show that changes in internalizing behaviors are uniquely related to changes in peer victimization experiences.

Clinical implications

The findings of the current study have clinical implications for the assessment and treatment of internalizing behaviors and peer victimization among children with and without ADHD. Given results indicating that greater internalizing behaviors were related to higher concurrent rates of peer victimization and longitudinal findings suggesting that internalizing behaviors and peer victimization were dynamically related, therapeutic treatment techniques designed to reduce internalizing behaviors may also concurrently reduce the frequency of peer victimization. For a child who is experiencing peer victimization, treatment of internalizing behaviors may be beneficial as it may reduce peer victimization concurrently and over time. Treatment interventions may benefit focus on assisting children who experience peer victimization with effective ways to respond to emotionally driven stimuli, manage feelings of negative emotions, cope with internal distress and execute effective prosocial behaviors in the presence of peers.

Additionally, reductions in internalizing behaviors may improve social functioning and decrease the risk of peer victimization experiences among children. Potential threats of peer conflict are likely to provoke extreme distress in children with internalizing behaviors due to the inability to manage and cope with negative emotions and engage in prosocial behaviors in the presence of peers. Children who demonstrate internalizing behaviors may benefit from cognitive-behavioral therapy, a treatment designed to change patterns of thinking or behavior. Cognitive-behavioral therapy appears especially useful in reducing internalizing behaviors in child populations (Kendall 1993) and may improve a child's ability to execute effective coping strategies in the presence of negative emotions. The inability to regulate negative emotions has been associated with increased rates of peer victimization (Rosen et al. 2012; Fogleman et al. 2016), and children with internalizing behaviors may benefit from treatments focused on managing and coping with strong negative emotions. Therapeutic treatment may improve a child's ability to regulate negative emotions and implement appropriate coping strategies, which may ultimately reduce peer victimization and improve social functioning. Through use of effective emotion regulation and coping skills, a child may be able to appropriately assert themselves in social situations and mitigate future episodes of victimization.

Findings appear differentially related to children with and without ADHD, such that children with internalizing behaviors report higher rates of peer victimization in the presence of ADHD. Children with ADHD experience considerable difficulties with emotional reactivity and regulation (Shaw et al. 2014) and often demonstrate more frequent internalizing behaviors when compared to unaffected peers (Eiraldi et al. 1997). Treatment focusing on addressing co-occurring internalizing behaviors in children with ADHD may assist with reducing social impairment and/or peer victimization. Although research has supported the use of stimulant medications and parent training on ADHD symptoms of impulsivity, inattention and hyperactivity (Pelham and Fabiano 2008), these treatments do not address co-occurring internalizing behaviors (MTA Cooperative Group 2004) and may be ineffective for treatment of peer victimization in children with ADHD and internalizing behaviors. Additional studies by Shaw et al. (2014) and Waxmonsky et al. (2012) failed to identify effective interventions designed to treat emotional difficulties in children with ADHD. Therefore, psychosocial treatments designed specifically to reduce internalizing behaviors may be useful in improving social functioning and alleviating peer victimization in children with ADHD. Given that children with ADHD are predisposed toward more intense emotional reactivity and impulsivity, treatments focusing on managing emotional reactivity, impulsivity and developing coping skills may improve prosocial behaviors and reduce peer victimization in children with ADHD and co-occurring internalizing behaviors.

Limitations

This study provided evidence for the association between internalizing behaviors, externalizing behaviors, and peer victimization among children with and without ADHD. However, several limitations must be acknowledged. This study represented a 6-month examination of the relation of internalizing and externalizing behaviors and peer victimization in children with and without ADHD both concurrently and longitudinally. While this study demonstrated that internalizing behaviors and peer victimization share a dynamic

relation, multiple a priori and alternative analyses were conducted, increasing the likelihood of a Type I error. Future studies should attempt to replicate findings for the association between internalizing behaviors and peer victimization.

The current study would have benefitted from a larger sample of participants. Eighteen children did not participate in the follow-up visit. The rate of follow-up for this study was 77.5%. Fischer, Dornelas, and Goethe (2001) suggested that usual rates of retention vary between 30 and 80%. Given that previous studies have identified populations with ADHD are commonly associated with attrition (Green et al. 1994), the current retention rate of 77.5% appears sufficient for the study sample. Future studies assessing the relation between internalizing behaviors, externalizing behaviors, and peer victimization in children with and without ADHD using a larger sample size over a longer period of time is warranted to substantiate and expand upon findings of the current study.

Parents were informed of their child's diagnostic status after completing the initial baseline session and medication and psychosocial treatment were free to vary throughout the 6-month study design. This is particularly notable given that the children with ADHD represented a community rather than a clinical sample. Thus, several of the children in the ADHD group had not previously received a diagnosis of ADHD prior to their participation in this study (preexisting diagnostic status was not recorded for this study) and were treatment naïve. As such, participants may have initiated medication or psychosocial treatment as a result of the diagnostic evaluation at the baseline session. Given that it would have been unethical to withhold information pertaining to diagnosis and treatment, this limitation was unavoidable. However, initiation of medication and/or psychosocial treatment following the baseline session may have affected longitudinal results observed at the 6-month follow-up session. In particular, children with ADHD and/or internalizing behaviors may have received medication and/or psychosocial treatment which may have improved their emotional, behavioral, and/or peer functioning, which in turn may have reduced their risk of peer victimization experiences over the 6-month period between the baseline and follow-up.

The current study failed to replicate previous studies suggesting a relation between externalizing behaviors and peer victimization (Hanish and Guerra 2002; Sullivan et al. 2006; Hodges et al. 1999). A limitation for this finding may be due differences observed in externalizing behaviors at baseline and follow-up sessions. Externalizing behaviors were found to be significantly lower in the follow-up sample, reinforcing previous research suggesting that children with externalizing behaviors have a higher risk of parents dropping out of clinical research studies (Cotter et al. 2005). Given there was a difference in total externalizing behaviors between baseline and follow-up, it is possible that although externalizing behaviors were not related to concurrent peer victimization, they may have predicted future peer victimization had the entire sample returned for the 6-month follow-up session. Previous literature suggests that child characteristics such as anxiety, an internalizing behavior, did not predict attrition in research protocols (Caspi et al. 1996; Reinherz et al. 1999) and longitudinal designs are favorable for assessing internalizing disorders (Ollendick and King 1994). These may be a couple of reasons why internalizing behaviors, and not externalizing behaviors, were identified as a predictor for future peer victimization.

The PPSS child-report measure used in this study also represents a potential limitation due to evidence of a relation between ADHD and the positive illusory bias (Hoza et al. 2004); however, studies suggest that child-report of peer victimization contributes valid and unique variance toward the assessment of peer victimization (Ladd and Kochenderfer-Ladd 2002). Given that children with ADHD often overestimate their social competence, they may suffer from greater amounts of peer victimization than was currently observed. Therefore, it is important that future studies attempt to replicate the results of these studies incorporating multiple measures of assessment (i.e., peer sociometric, parent report, teacher report) to determine how these results generalize across differing reporters of peer victimization.

Furthermore, ADHD was determined by the DISC-P (Shaffer et al. 2000) and VAPRS (Wolraich et al. 2003). A multi-informant approach was not used to diagnose ADHD in the current study due to practical limitations. While the DISC-P (Shaffer et al. 2000) and VAPRS (Wolraich et al. 2003) have each demonstrated reliability and validity in the assessment of ADHD in children, use of a reliable and valid teacher instrument would have assisted in confirming ADHD diagnosis, especially given evidence that the use of multiple informants decreases the prevalence of ADHD (Mitsis et al. 2000; Wolraich et al. 2004). Future studies should attempt to incorporate a multi-informant approach to ADHD diagnoses.

Conclusion

The current study demonstrates that internalizing behaviors were related to peer victimization concurrently in children with and without ADHD, and over time, as internalizing behaviors corresponded to peer victimization experiences. Internalizing behaviors appear to uniquely impact children who experience peer victimization, as the inability to regulate, control and cope with internal distress inhibits children's ability to control their negative emotions and engage in prosocial behaviors. This pattern of impairment is differentially related to concurrent peer victimization by ADHD and also uniquely associated for children who exhibit greater

levels of internalizing behaviors; these children are more likely to be victimized by their peers.

Compliance with ethical standards

Conflict of interest All the authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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