

# Longitudinal Study of Neuropsychological Functioning and Internalizing Symptoms in Youth With Spina Bifida: Social Competence as a Mediator

Jaclyn M. Lennon,<sup>1</sup> BS, Kimberly L. Klages,<sup>1</sup> BS, Christina M. Amaro,<sup>2</sup> BS, Caitlin B. Murray,<sup>1</sup> MA, and Grayson N. Holmbeck,<sup>1</sup> PhD

<sup>1</sup>Psychology Department, Loyola University Chicago and <sup>2</sup>Clinical Child Psychology Program, University of Kansas

All correspondence concerning this article should be addressed to Jaclyn M. Lennon, BS, Department of Psychology, Loyola University Chicago, Chicago, IL 60660, USA. E-mail: jlenno2@luc.edu

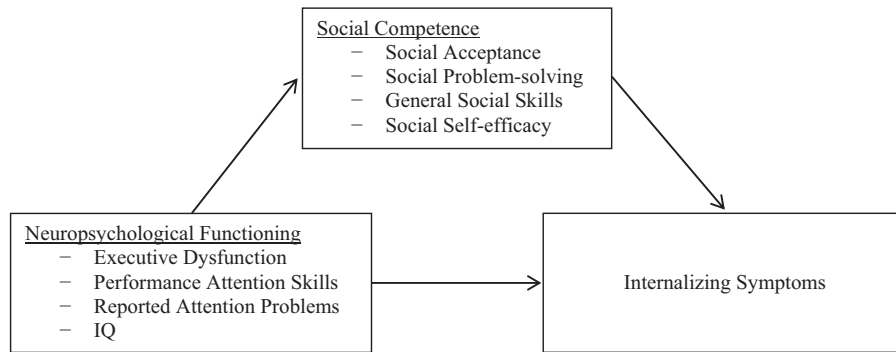
Received February 28, 2014; revisions received and accepted August 13, 2014

**Objective** To examine the longitudinal relationship between neuropsychological functioning and internalizing symptoms, as mediated by social competence in youth with spina bifida (SB). **Methods** A total of 111 youth (aged 8–15 years,  $M = 11.37$ ) with SB, their parents, and teachers completed questionnaires regarding attention, social competence, and internalizing symptoms. Youth also completed a battery of neuropsychological tests. **Results** An indirect-only mediation model revealed that social competence mediated the relation between neuropsychological functioning and subsequent levels of teacher-reported internalizing symptoms, but not parent or youth report of internalizing symptoms. Specifically, better neuropsychological functioning was associated with better social competence, which, in turn, predicted fewer internalizing symptoms 2 years later. **Conclusions** Youth with SB with lower levels of neuropsychological functioning may be at risk for poorer social competence and, as a result, greater internalizing symptoms. Interventions that promote social competence, while being sensitive to cognitive capacities, could potentially alleviate or prevent internalizing symptoms in these youth.

**Key words** internalizing symptoms; neuropsychological functioning; social competence; spina bifida.

Youth with spina bifida (SB) have been identified as being at risk for psychosocial difficulties, including poor social competence and increased internalizing symptoms (Ammerman et al., 1998; Holmbeck & Devine, 2010; Holmbeck et al., 2003, 2010). SB is a congenital birth defect caused by incomplete closure of the neural tube during the early weeks of gestation. In addition to serious health complications, such as paralyzed lower extremities, bladder and bowel incontinence, and seizures, many individuals with SB develop hydrocephalus, which is commonly treated with a shunt at birth (Holmbeck et al., 2003). The purpose of the current study is to test the utility of a longitudinal mediational model (see Figure 1) that posits associations between neuropsychological functioning and internalizing symptoms as mediated by social competence.

Previous work has revealed that youth with SB are at higher risk for psychological maladjustment compared with typically developing youth (Holmbeck et al., 2003), and research on predictors of internalizing symptoms in this population has emerged as an important area of inquiry (e.g., Bellin et al., 2010). In particular, neuropsychological functioning (i.e., executive dysfunction, performance attention skills, reported attention problems, and IQ) may be a salient domain that impacts internalizing symptoms in youth with SB. Due to brain malformations characteristic of SB and the consequences of shunt placement at birth (i.e., shunt infections and replacement), the majority of youth with SB display mild to moderate cognitive impairments, such as executive dysfunction, inattention, and impaired intellectual functioning (Rose & Holmbeck, 2007).



**Figure 1.** The effect of neuropsychological functioning on internalizing symptoms, as mediated by social competence.

Researchers investigating the link between neuropsychological functioning and internalizing symptoms have proposed a biopsychosocial model of chronic illness, which suggests that youth who have executive function deficits may exhibit difficulties shifting attention from stressful stimuli and, thus, may be at an increased risk for internalizing symptoms (Compas & Boyer, 2001). In support of this model, executive function deficits that are common in SB (i.e., difficulties in the areas of metacognition, encoding, focusing, and shifting attention; Loss, Yeates, & Enrile, 1998; Zabel et al., 2013) have been linked to internalizing symptoms (Kelly et al., 2012). Further, while research to date has not examined the impact of inattention on internalizing symptoms in this population, inattention has been linked to greater internalizing symptoms in other pediatric populations (e.g., children with chronic fatigue syndrome; Tucker, Haig-Ferguson, Eaton, & Crawley, 2011). Similarly, low verbal IQ has been linked to greater internalizing symptoms (i.e., anxiety) in youth with epilepsy (Caplan et al., 2005). However, there have been variable results with regard to the link between IQ and internalizing symptoms in youth with SB. One study found that verbal IQ is not a significant predictor of depressive symptoms (Schellinger, Holmbeck, Essner, & Alvarez, 2012), whereas another study found that lower verbal IQ is predictive of poorer psychosocial adaptation (Coakley, Holmbeck, & Bryant, 2006).

Although studies examining associations between neuropsychological functioning and internalizing symptoms in pediatric populations have steadily increased in the past decade, less attention has been paid to underlying mechanisms, or mediators, of this association. In particular, the link between neuropsychological functioning and internalizing symptoms may be mediated by social competence, such that neuropsychological functioning may impact social competence, which, in turn, may impact internalizing symptoms. Previous research on youth with SB has

identified significant social deficits that map onto Cavell's (1990) tri-component model of social competence: (1) social adjustment (e.g., fewer close friendships; Devine, Holmbeck, Gayes, & Purnell, 2012), (2) social performance (e.g., social immaturity, withdrawal, and passivity; Ammerman et al., 1988; Holmbeck et al., 2003; Rose & Holmbeck, 2007), and (3) social skills (e.g., inappropriate sociability and verbosity; Burmeister et al., 2005).

Highlighting the impact of neuropsychological functioning on social competence, Rose and Holmbeck (2007) found that both performance- and questionnaire-based measures of executive dysfunction contributed to social competence impairment in youth with SB. Further, youth with SB exhibiting deficits in problem solving and planning may have difficulty performing appropriate social behavior, such as communicating necessary information to peers (i.e., social language) and understanding the rules of social engagement (Landry, Robinson, Copeland, & Garner, 1993). Symptoms of inattention may also impact social competence and internalizing symptoms in youth with SB. Individuals with SB tend to exhibit attention problems that are similar to children with attention-deficit/hyperactivity disorder (ADHD), including high distractibility, poor organization of materials, and difficulty staying on task (Burmeister et al., 2005). Children with ADHD often have peer conflicts, are less popular with peers, experience higher levels of peer rejection, and lack close friendships. These social difficulties evident in children with ADHD appear to increase their risk of later psychopathology (Nijmeijer et al., 2008). Similarly, preliminary findings have revealed that adolescents with SB have enduring attention problems that are associated with difficulties with social competence (Rose & Holmbeck, 2007), such as fewer friendships and a lower level of closeness with same-age peers (Holmbeck et al., 2010). Further, with regard to the link between IQ and social competence, children with intellectual disabilities may show decreased

social competence, including poor peer relationships, social withdrawal, and delayed development of social skills (e.g., difficulties with communication and using appropriate social interaction strategies; Bellanti & Bierman, 2000; Guralnick, 1999; Zion & Jenvey, 2011).

Finally, the connection between social competence and internalizing symptoms has shown strong and consistent support in the literature. Social competence difficulties, such as peer rejection, have been linked to increases in internalizing symptoms in several pediatric populations, including children with inflammatory bowel disease (Greenley et al., 2010), glycogen storage disease type 1 (Storch et al., 2008), pediatric pain (i.e., disease- and non-disease-related pain; Claar & Walker, 2006; Gauntlett-Gilbert & Eccleston, 2007; Peterson & Palermo, 2004; Sandstrom & Schanberg, 2004), and youth with SB (Essner, Murray, & Holmbeck, 2014). Youth may experience increased internalizing symptoms as a result of poor social competency for a variety of reasons, including limited social interactions, feelings of low self-worth related to peer status, or increased anxiety in social situations.

While studies have begun to investigate associations among neuropsychological functioning, social competence, and internalizing symptoms in youth with SB, these domains have yet to be tested within one unified model. Thus, the purpose of this study was to examine the utility of a model of neuropsychological functioning (i.e., executive dysfunction, performance attention skills, reported attention problems, and IQ), social competence, and internalizing symptoms in youth with SB (see Figure 1). It was expected that social competence would mediate the relationship between neuropsychological functioning and internalizing symptoms in youth with SB. Specifically, executive dysfunction, inattention, and lower IQ were expected to predict lower levels of social competence that, in turn, would predict increased internalizing symptoms in this population.

## Methods

### Participants

Participants were part of a larger longitudinal investigation examining family, psychosocial, and neuropsychological functioning among youth with SB (see Devine et al., 2012). Families of youth with SB were recruited from four hospitals and a statewide SB association in the Midwest. Inclusion criteria for children with SB consisted of (1) a diagnosis of SB (types included myelomeningocele, lipomeningocele, and myelocystocle); (2) age 8–15 years at Time 1; (3) ability to speak and read English and/or

Table 1. Child Demographic and Spina Bifida Information at Time 1

Variable	<i>M</i> ( <i>SD</i> ) or % ( <i>N</i> = 140)
Age	11.43 (2.46)
Gender (male)	45.7
Ethnicity	
Caucasian	52.1
Hispanic	26.4
African-American	12.1
Other	5.8
Not reported	3.6
Family SES <sup>a</sup>	39.44 (15.90)
Spina bifida type	
Myelomeningocele	86.4
Lipomeningocele	6.4
Other	5.8
Unknown/not reported	1.4
Lesion level	
Thoracic	16.4
Lumbar	48.6
Sacral	29.3
Unknown/not reported	5.7
Shunt present	77.9

Note. <sup>a</sup>*n* = 130 owing to missing data; SES = socioeconomic status measured by Hollingshead Four-Factor Index.

Spanish; (4) involvement of at least one primary caregiver; and (5) residence within 300 miles of laboratory (to allow for home visits for data collection). During recruitment, 246 families were approached; 163 families agreed to participate, but 21 of those families were unable to be contacted or later declined, and 2 families did not meet inclusion criteria. Thus, the final sample of participants included 140 families of youth with SB (54.3% female; *M* age = 11.43). Youth of families who declined to participate did not differ from participants with respect to type of SB (myelomeningocele or other),  $\chi^2(1) = 0.0002$ ,  $p > .05$ , shunt status,  $\chi^2(1) = 0.003$ ,  $p > .05$ , or occurrence of shunt infections,  $\chi^2(1) = 1.08$ ,  $p > .05$ . Table 1 displays child demographic and SB information at Time 1. Two waves of data collection were conducted 2 years apart, starting at ages 8–15 years at Time 1 and ages 10–17 years at Time 2. Data were collected at Time 2 for 111 (79%) of the original 140 participants. Reasons for attrition at Time 2 (*n* = 29): 16 participants declined to participate, 12 participants were unable to be contacted, and 1 participant was deceased. Youth of families who did not participate at Time 2 did not differ from participants with respect to gender  $\chi^2(1) = 0.28$ ,  $p > .05$ , socioeconomic status (SES),  $t(128) = -1.86$ ,  $p > .05$ , type of SB (myelomeningocele or other),  $\chi^2(1) = 1.19$ ,  $p > .05$ , lesion level (thoracic or other),  $\chi^2(1) = 0.72$ ,  $p > .05$ , or

shunt status,  $\chi^2(1) = 2.73, p > .05$ . However, youth who did not participate at Time 2 were significantly older at Time 1 ( $M = 12.62$  compared with 11.12),  $t(138) = 3.02, p = .003$ .

### Procedure

This study was approved by university and hospital institutional review boards. Trained research assistants collected data during two separate 2-hr home visits at Time 1 and one 3-hr home visit at Time 2. Parental consent and child assent were obtained at the participant's home. Additionally, parents were asked to sign release forms for medical chart review, teacher participation, and health professional participation to obtain additional information regarding the youth. During home visits, youth with SB and their parents completed questionnaires separately. Youth completed neuropsychological testing lasting 1.5 hr at Time 1 and 1 hr at Time 2. Families also participated in video-recorded family interaction tasks, and data were collected from a peer of each youth, although these data were not used for the current study. Families received \$150 and small gifts (i.e., logo t-shirts, pens, water bottles) for their participation.

### Measures

#### Demographic and Illness Information

Parents completed a demographic questionnaire to report on youth age, gender, and race/ethnicity. Parents also reported on their education and employment, which were used to compute the Hollingshead index of SES, with higher scores indicating higher SES (Hollingshead, 1975). Data regarding youth's type of SB (i.e., myelomeningocele, lipomeningocele, or other), lesion level (i.e., thoracic, lumbar, or sacral), and shunt status were primarily drawn from medical charts, but in cases where such data were missing, data were drawn from the Medical History Questionnaire (Holmbeck et al., 2003) completed by parents.

#### Neuropsychological Functioning

The current study used neuropsychological data collected at Time 1. Both performance-based (i.e., Test of Everyday Attention for Children [TEA-Ch], Wechsler Abbreviated Scale of Intelligence [WASI]) and questionnaire (i.e., Behavior Rating Inventory of Executive Function [BRIEF], Child Behavior Checklist [CBCL] Attention Problems subscale) measures were used to provide a broad-based measure of neuropsychological functioning.

**Executive Dysfunction.** Executive functions were measured using mother, father, and teacher report on the BRIEF

(Gioia, Isquith, Guy, & Kentworthy, 2000). The BRIEF consists of eight subdomains that fall within two broad second-order scales: Behavioral Regulation, which contains the Inhibit, Shift, and Emotional Control subdomains, and Metacognition which contains the Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor subdomains. The parent-report version includes 85 items (mother report:  $\alpha = .84$  for Behavioral Regulation,  $\alpha = .90$  for Metacognition; father report:  $\alpha = .81$  for Behavioral Regulation,  $\alpha = .88$  for Metacognition), whereas the teacher-report version includes 86 items ( $\alpha = .90$  for Behavioral Regulation,  $\alpha = .92$  for Metacognition; e.g., "Makes careless mistakes") that were rated as "never," "sometimes," or "often" a problem for the child. Higher scores on the subtests are indicative of higher levels of executive dysfunction. Because mother, father, and teacher reports for the Behavioral Regulation and Metacognition subscales were highly intercorrelated ( $\alpha = .75$  when all reports were examined for internal consistency), these six scale scores were aggregated to compute an executive dysfunction composite.

**Attention.** Attention was assessed using both performance- and questionnaire-based measures. Because performance attention skills and reported attention problems were not highly correlated ( $r = -.23, p < .05$ ), these measures were analyzed separately.

**Performance Attention Skills.** Youth were administered the Sky Search DT and Score DT subtests of the TEA-Ch (Manly, Robertson, Anderson, & Nimmo-Smith, 1999). These two subtests were chosen because they require attention to multiple stimuli, thus, mimicking the attention demands of social interactions. During the Sky Search DT task, which assesses sustained-divided attention, participants circled pairs of identical items while simultaneously counting the number of "scoring sounds" from an audio-recording. During the Score DT task, which assesses sustained attention, participants counted the number of "scoring sounds" from an audio-recording while simultaneously listening for the name of an animal. Higher scores indicate better attention skills. Given the significant moderate correlation ( $r = .34, p < .001$ ) between the DT subscales, a composite score was created.

**Reported Attention Problems.** Attention was also measured using mother and father report on the CBCL (Achenbach & Rescorla, 2001) and teacher report on the Teacher Report Form (TRF; Achenbach & Rescorla, 2001). The CBCL and TRF consist of 118 items that describe behavioral and emotional problems, each rated on a three-

point scale (0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very true or often true*). This study used T scores from the Attention Problems subscale, with higher scores indicating greater attention problems. Because mother, father, and teacher reports on the Attention Problems subscale were highly intercorrelated ( $\alpha = .73$ ), scores were aggregated to compute a composite for reported attention problems.

**IQ.** General intellectual ability was measured using the Vocabulary and Matrix Reasoning subtests of the WASI (Wechsler, 1999) to compute an estimated full-scale IQ.

### Social Competence

The current study used social competence data collected at Time 1. Social competence was operationally defined based on Cavell's (1990) tri-component model, in which social competence includes social adjustment (i.e., *social acceptance* by peers), social performance (i.e., *social problem-solving*), and social skills (i.e., *general social skills* and *social self-efficacy*). Data reduction techniques were used for social competence measures to reduce the number of analyses. Subscale scores were combined to create a social competence composite variable (see below for further details).

**Social Acceptance.** Social acceptance was examined using measures of parent, teacher, and youth report on the Social Acceptance subscale from the appropriate reporter versions of Harter's (1985) Self-Perception Profile for Children scale; parents completed the Parent's Rating Scale of Child's Actual Behavior, teachers completed the Teacher's Rating Scale of Child's Actual Behavior, and youth completed the What I Am Like measure. All three versions consist of items for which the respondent is asked to identify which of two statements best describes the youth (e.g., "My child finds it hard to make friends" or "For my child it's pretty easy"), and then to decide whether the statement is "really true" or "sort of true." The parent and teacher version subscales consist of three items ( $\alpha$  values = .76, .82, and .92 for mother, father, and teacher report, respectively) and the youth version subscale consists of six items ( $\alpha = .60$ ), with higher scores indicating greater social acceptance. These versions have demonstrated adequate psychometric properties (Cole, Gondoli, & Peeke, 1998), and previous research (e.g., Holmbeck et al., 2003) has shown alpha coefficients to range from .67 to .93 for youth with SB.

**Social Problem Solving.** Youth completed the Social Goals and Problem Solving-Rejection Expectations scale, adapted for this study from the Rejection Expectations scale (Pope, 2005) and the Middle School Alternative Solutions Task

(Caplan, Weissberg, Bersoff, Ezekowitz, & Wells, 1986) as a measure of social skills. This measure includes 10 social problem vignettes, 3 of which are SB related (e.g., getting to know a new student and telling him/her about SB), and asks participants to provide examples of what he or she might say or do in each social situation. Up to three responses for each vignette were coded on a 5-point scale by category (e.g., aggressive, passive, simple request), probability that the solution will have negative relational effects, severity of negative relational effects, social skill, effectiveness, and planfulness. Responses were coded by two independent raters. Inter-rater reliability for the Effectiveness ( $\alpha = .97$ ) and Social Skill ( $\alpha = .95$ ) items used in the current study was high, so scores from both raters were collapsed, with higher scores indicating greater effectiveness and social skill. Both items were highly correlated ( $r = .98$ ,  $p < .001$ ) and so were averaged together.

**General Social Skills.** Social skills were assessed using mother, father, and teacher report on the Social Skills subscale of the Social Skills Rating System (SSRS; Gresham & Elliot, 1990). For the Social Skills subscale, the parent form consists of 38 items ( $\alpha = .91$  for mother report,  $\alpha = .92$  for father report) and the teacher form consists of 30 items ( $\alpha = .93$ ), which ask reporters to rate how often the youth demonstrates a particular social skill (0 = *never*, 1 = *sometimes*, 2 = *very often*).

**Social Self-Efficacy.** Youth's perceived self-efficacy in social situations was measured using the Children's Self-Efficacy for Peer Interaction scale (CSPI; Wheeler & Ladd, 1982). The CSPI consists of 22 items describing social situations and is followed by an incomplete sentence requiring the respondent to evaluate his or her ability to perform the persuasive skill (e.g., "Some kids want to play a game. Asking them if you can play is \_\_\_\_ for you."). The reporter answers each item using a 4-point scale ("very hard" to "very easy") that yields a total score, with higher scores indicating greater self-efficacy. This scale has demonstrated validity and adequate internal consistency (Wheeler & Ladd, 1982;  $\alpha = .82$  in this study). Four items were dropped from the original scale because the wording (e.g., using your play area) was not age appropriate.

To determine whether it was possible to combine the social competence subscales into a composite, the scores from the nine social competence scales were transformed into  $z$  scores by subtracting the mean from each score and dividing by the standard deviation. These nine  $z$  scores were included in an alpha analysis, where they demonstrated adequate internal consistency ( $\alpha = .71$ ). Thus, they were averaged together to form a social competence

composite that includes the following subscales: (1) mother, (2) father, and (3) teacher report on the SSRS; (4) the Social Goals and Problem Solving composite; (5) mother, (6) father, (7) teacher, and (8) youth report on the Harter; and (9) the youth report on the CSPI.

### Internalizing Symptoms

At Time 1 and Time 2, youth completed the Children's Depression Inventory (CDI; Kovacs, 1992), a 27-item measure of depressive symptoms. Each item consists of three choices that are rated as 0, 1, or 2, with higher scores indicating a higher level of severity of symptoms ( $\alpha = .77$ ).

In addition, at Time 1 and Time 2, Internalizing Problems T-scores were derived from mother and father report on the CBCL (Achenbach & Rescorla, 2001) and teacher report on the TRF (Achenbach & Rescorla, 2001), with higher scores indicating greater internalizing symptoms. Given the moderate correlation ( $r = .36$ ,  $p < .01$ ) between mother and father reports, scores were averaged to create a parent-report composite. Teacher report was not significantly correlated with parent report ( $r = .17$ ) or youth report ( $r = .04$ ) on the CDI, and parent report was not significantly correlated with youth report on the CDI ( $r = .18$ ), so the three scores were analyzed separately.

### Statistical Analysis

All data analyses were conducted using Statistical Package for the Social Sciences (SPSS version 20). Preacher and Hayes' (2008) bootstrapping methods were used to determine the effect of neuropsychological functioning at Time 1 on youth's internalizing symptoms at Time 2 (controlling for internalizing symptoms at Time 1), as mediated by youth's social competence at Time 1. Bootstrapping has been validated in the literature and is preferred over other methods, such as the Sobel Test (Preacher & Hayes, 2008). With bootstrapping, there are fewer parameter estimates and power remains high, which reduces the possibility of Type II errors (Preacher & Hayes, 2008). This procedure generates an empirical approximation of the product of the estimated coefficients' sampling distribution in the direct path, percentile-based bootstrap 95% confidence intervals (CIs), and bootstrap measures of standard errors using 5000 resamples, with replacement, from the data set (Preacher & Hayes, 2008). When zero is not between the upper and lower bounds of the CI, it can be claimed with 95% confidence that the indirect effect is not zero, indicating a significant indirect effect. A total of three models were run, one for each reporter (i.e., parent, teacher, youth) of the internalizing symptoms outcome variable. Each of these outcome variables were predicted by the four neuropsychological variables at Time 1, mediated

by the social competence composite at Time 1, while controlling for youth age, SES, and youth's internalizing symptoms at Time 1.

Missing data were handled using listwise deletion. Listwise  $n$  values were 84, 73, and 83 for parent-, teacher-, and youth-report models, respectively. Missing data were due in part to the difficulty of obtaining all data in a multisource multimethod longitudinal study (Holmbeck, Li, Schurman, Friedman, & Coakley, 2002). Also, the large number of variables within each model (i.e., nine variables) allowed for a smaller listwise sample size because of the variance in  $n$  values of each variable. In addition, the fact that data are missing for the teacher-report model is due in part to the difficulty of recruiting and collecting data from teachers. Assuming a power of .80, and an alpha of .05, a sample size of 78 is required to detect medium effect sizes and a sample size of 36 is required to detect large effect sizes (Fritz & MacKinnon, 2007). Thus, the current study has enough power to detect both medium and large (but not small) effect sizes for parent- and youth-report models, but only enough power to detect large effects for the teacher-report model.

## Results

### Preliminary Analyses

Table II displays means, standard deviations, actual ranges, and correlations for study variables. All four neuropsychological variables were significantly correlated with each other ( $p$  values  $< .05$ ). In addition, the social competence composite was significantly correlated with all four neuropsychological variables ( $p$  values  $< .001$ ), as well as parent- and teacher-reported internalizing symptoms at Time 1 and Time 2, and youth-reported internalizing symptoms at Time 1 ( $p$  values  $< .05$ ). As previously discussed, the three internalizing symptoms variables were not significantly correlated with each other at Time 2, but parent- and youth-reported internalizing symptoms were correlated at Time 1 ( $p < .05$ ). Moreover, child-reported internalizing symptoms at Time 2 was not correlated with any other study variable ( $p$  values  $> .05$ ).

### Mediation Analyses

Three multiple predictor mediation models were tested with nonparametric bootstrapping (resampling procedure; Preacher & Hayes, 2008). Each model had the same four independent variables and mediating variable, predicting a different internalizing symptoms outcome variable in each model (i.e., parent, teacher, or youth reported; Table III).

Table II. Correlations Among Study Variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Executive dysfunction	–	–.26**	.71***	–.23**	–.44***	.37***	.14	.26**	.37***	.17	.03
2. Performance attention skills		–	–.23*	.52***	.37***	–.11	–.22*	–.38***	–.06	–.21	–.19
3. Reported attention problems			–	–.24**	–.43***	.40***	.26**	.23*	.31**	.29**	.09
4. IQ				–	.38***	–.12	–.21*	–.28**	–.03	–.35**	–.11
5. Social competence composite					–	–.27**	–.43***	–.21*	–.23*	–.46***	–.15
6. T1 internalizing: parent report <sup>a</sup>						–	.07	.24*	.70***	.06	.14
7. T1 internalizing: teacher report <sup>a</sup>							–	.11	.02	.40***	.00
8. T1 internalizing: child report <sup>a</sup>								–	.26*	.14	.20
9. T2 internalizing: parent report									–	.17	.18
10. T2 internalizing: teacher report										–	.04
11. T2 internalizing: child report											–
M (SD)	60.9(11.5)	6.6(3.4)	56.7(5.0)	85.7(19.7)	0.1(0.5)	54.7(9.8)	55.5(10.0)	1.3(0.2)	53.1(9.1)	53.6(10.3)	1.3(0.2)
Actual range	37.0–98.0	1.0–16.0	50.0–72.7	55.0–137.0	–1.3–1.3	33.0–81.0	37.0–80.0	1.0–2.2	33.0–81.0	37.0–84.0	1.0–1.8

Note. <sup>a</sup>T1 Internalizing variables are covariates. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

### Parent-Reported Internalizing Symptoms

First, we evaluated whether social competence mediates the association between neuropsychological functioning (i.e., executive dysfunction, performance attention skills, reported attention problems, IQ) and parent-reported internalizing symptoms. Results indicated that neither direct nor indirect effects were significant (indirect estimated effect =  $-.61$ ,  $SE = 0.92$ , 95% CI lower to upper =  $-2.52$  to  $1.17$ ; see Figure 2). This indicates that social competence does not mediate the relationship between the neuropsychological predictors and parent-reported internalizing symptoms.

### Teacher-Reported Internalizing Symptoms

Next, we evaluated whether social competence mediates the association between neuropsychological functioning and teacher-reported internalizing symptoms. Results indicated that social competence mediated the relationship between all four neuropsychological variables collectively and teacher-reported internalizing symptoms (indirect estimated effect =  $-1.85$ ,  $SE = 1.18$ , 95% CI lower to upper =  $-4.68$  to  $-0.19$ ; see Figure 3). An examination of the specific indirect effects indicated that reported attention problems was the only nonsignificant individual predictor of internalizing symptoms, as mediated by social competence (see Table III). In addition, the omnibus tests of the direct effect and total effect of the neuropsychological variables on internalizing symptoms were not significant, suggesting that this model represents *indirect-only mediation* (see Zhao, Lynch, & Chen, 2010). However, within the total effects model, there was a significant univariate effect of IQ on internalizing symptoms, where lower IQ predicted greater internalizing symptoms (path coefficient =  $-0.18$ ,  $SE = 0.08$ ).

Table III. Effect of Neuropsychological Functioning on Internalizing Symptoms, as Mediated by Youth's Social Competence

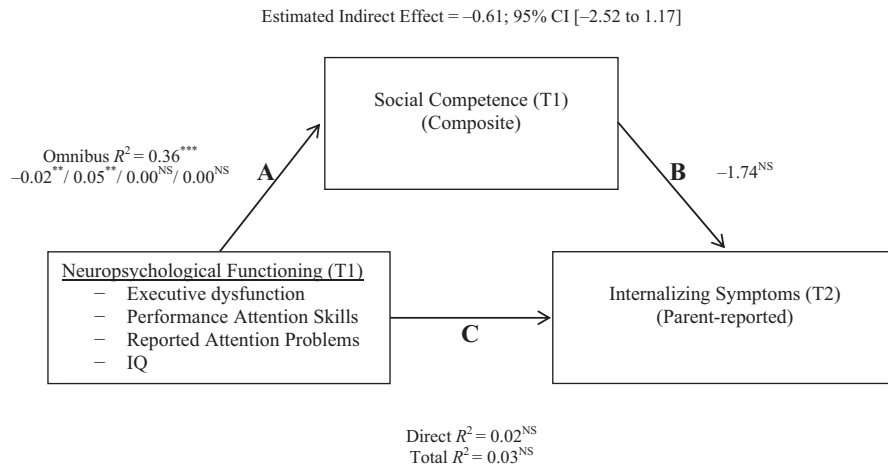
Model	Bootstrapping 95% CI			
	Coeff.	SE	Lower	Upper
Parent-reported internalizing symptoms				
Executive dysfunction	0.04	0.05	–0.06	0.15
Performance attention skills	–0.09	0.13	–0.34	0.16
Reported attention problems	–0.01	0.06	–0.19	0.07
IQ	–0.01	0.01	–0.05	0.01
Total mediational model	–0.61	0.92	–2.52	1.17
Teacher-reported internalizing symptoms				
<b>Executive dysfunction</b>	<b>0.14</b>	<b>0.09</b>	<b>0.01</b>	<b>0.37</b>
<b>Performance attention skills</b>	<b>–0.24</b>	<b>0.16</b>	<b>–0.67</b>	<b>–0.02</b>
Reported attention problems	–0.14	0.18	–0.67	0.07
<b>IQ</b>	<b>–0.05</b>	<b>0.04</b>	<b>–0.16</b>	<b>–0.01</b>
<b>Total mediational model</b>	<b>–1.85</b>	<b>1.18</b>	<b>–4.68</b>	<b>–0.19</b>
Child-reported internalizing symptoms				
Executive dysfunction	0.00	0.00	–0.00	0.00
Performance attention skills	–0.00	0.00	–0.01	0.00
Reported attention problems	0.00	0.00	–0.00	0.00
IQ	–0.00	0.00	–0.01	0.00
Total mediational model	–0.01	0.02	–0.06	0.03

Note. Significant indirect effects are bolded. *Coeff.* = estimated indirect effect.

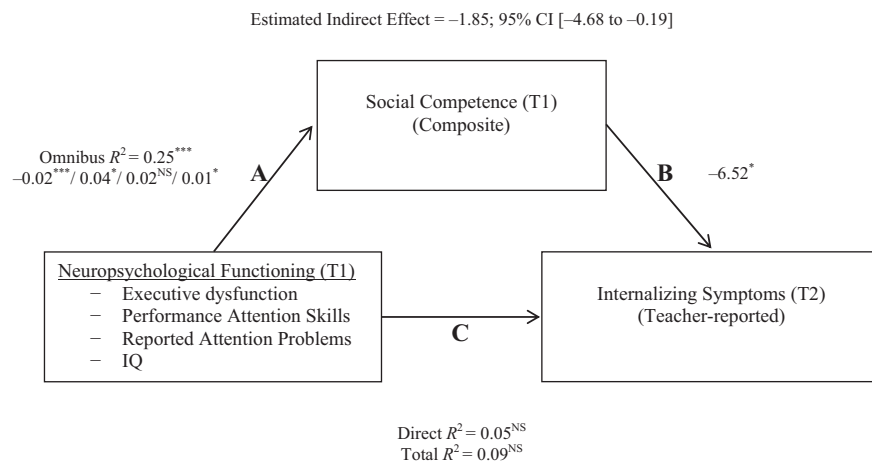
For each of the three dependent variables (i.e., internalizing symptoms), a total of five pathways were tested: A mediated path for each of the four independent variables (i.e., neuropsychological functioning) separately, as well as a total mediated path.

### Youth-Reported Internalizing Symptoms

Finally, we evaluated whether social competence mediates the association between neuropsychological functioning and youth-reported internalizing symptoms. Results indicated that neither direct nor indirect effects were significant (indirect estimated effect =  $-0.01$ ,  $SE = 0.02$ , 95% CI lower to upper =  $-0.06$  to  $0.03$ ; see Figure 4). This indicates that social competence



**Figure 2.** The mediation model of neuropsychological functioning, social competence, and parent-reported internalizing symptoms. Youth age, SES, and internalizing symptoms at Time 1 were controlled. "T1" refers to Time 1 and "T2" refers to Time 2. **Pathway A:**  $R^2$  value from the omnibus test of neuropsychological functioning on social competence. Individual path coefficients (presented left to right in top-down order matching list of variables in "Neuropsychological Functioning" box) for the effects of each neuropsychological functioning variable on social competence. **Pathway B:** Path coefficient for the effect of social competence on internalizing symptoms, controlling for neuropsychological functioning. **Pathway C:**  $R^2$  values from the omnibus test of the direct effect and the omnibus test of the total effect of neuropsychological functioning on internalizing symptoms. \*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$ ,  $^{NS}p > .05$ .



**Figure 3.** The mediation model of neuropsychological functioning, social competence, and teacher-reported internalizing symptoms. Youth age, SES, and internalizing symptoms at Time 1 were controlled. "T1" refers to Time 1 and "T2" refers to Time 2. **Pathway A:**  $R^2$  value from the omnibus test of neuropsychological functioning on social competence. Individual path coefficients (presented left to right in top-down order matching list of variables in "Neuropsychological Functioning" box) for the effects of each neuropsychological functioning variable on social competence. **Pathway B:** Path coefficient for the effect of social competence on internalizing symptoms, controlling for neuropsychological functioning. **Pathway C:**  $R^2$  values from the omnibus test of the direct effect and the omnibus test of the total effect of neuropsychological functioning on internalizing symptoms. Although the omnibus test of the total effect was not significant, the univariate total effect of IQ was significant (-0.18\*). \*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$ ,  $^{NS}p > .05$ .

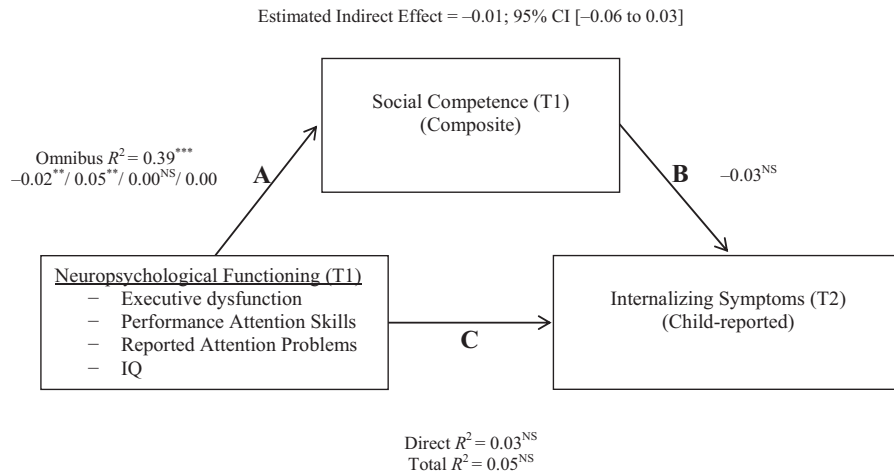
does not mediate the relationship between the neuropsychological predictors and youth-reported internalizing symptoms.

### Exploratory Analyses

Given that the youth in our sample range in age (i.e., 8–15 years at Time 1, 10–17 years at Time 2), we conducted

exploratory analyses to test whether the link between social competence and internalizing symptoms is moderated by age. Previous research suggests that youth with SB may demonstrate enduring social development difficulties throughout childhood and adolescence (Holmbeck et al., 2010). However, while typically developing youth tend to experience increasing internalizing symptoms as they





**Figure 4.** The mediation model of neuropsychological functioning, social competence, and child-reported internalizing symptoms. Youth age, SES, and internalizing symptoms at Time 1 were controlled. “T1” refers to Time 1 and “T2” refers to Time 2. **Pathway A:**  $R^2$  value from the omnibus test of neuropsychological functioning on social competence. Individual path coefficients (presented left to right in top-down order matching list of variables in “Neuropsychological Functioning” box) for the effects of each neuropsychological functioning variable on social competence. **Pathway B:** Path coefficient for the effect of social competence on internalizing symptoms, controlling for neuropsychological functioning. **Pathway C:**  $R^2$  values from the omnibus test of the direct effect and the omnibus test of the total effect of neuropsychological functioning on internalizing symptoms. \*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$ ,  $^{NS}p > .05$ .

progress through adolescence (Mash & Barkley, 2003), youth with SB do not demonstrate this same increase (Holmbeck et al., 2010). Thus, the pathway between social competence and internalizing symptoms in our presented model may differ depending on age.

Hayes and Matthes’ (2009) moderation methods for probing interactions in Ordinary Least Squares (OLS) regression were used to test three models, one for each internalizing symptoms outcome variable (i.e., parent report, teacher report, youth report). Each of these outcome variables was predicted by the social competence composite at Time 1, moderated by age at Time 1, while controlling for SES and the outcome variable at Time 1. Results revealed no significant main effects for social competence or age, for any of the three models ( $p$  values  $> .05$ ). In addition, there were no significant social competence  $\times$  age interaction effects, controlling for main effects, for the parent-report model ( $b = -.80$ ,  $t = -1.33$ ,  $p = .19$ ), teacher-report model ( $b = .47$ ,  $t = 0.55$ ,  $p = .59$ ), or youth-report model ( $b = .01$ ,  $t = 0.71$ ,  $p = .48$ ).

## Discussion

This study examined neuropsychological functioning (i.e., executive dysfunction, performance attention skills, reported attention problems, IQ), social competence, and internalizing symptoms in youth with SB. We predicted that social competence would mediate the relationship between neuropsychological functioning and internalizing

symptoms in youth with SB. Specifically, we initially speculated that greater executive dysfunction, lower performance attention skills, greater reported attention problems, and lower IQ would predict lower levels of social competence, which, in turn, would lead to increased internalizing symptoms 2 years later. Overall, when examining teacher report of youth internalizing symptoms, we found support for an indirect-only mediation model, where lower neuropsychological functioning was associated with lower social competence, which, in turn, was associated with greater internalizing symptoms. On the other hand, when examining parent- and youth-reported internalizing symptoms, results revealed no evidence of mediation; specifically, social competence did not mediate the relationship between the neuropsychological predictors and parent- or youth-reported internalizing symptoms.

The finding that there was not a significant total effect of neuropsychological functioning on internalizing symptoms is surprising in light of previous research on other pediatric populations that has found executive function deficits, inattention, and low verbal IQ to be linked to increased internalizing symptoms (Caplan et al., 2005; Kelly et al., 2012; Tucker et al., 2011). However, for the model examining teacher-reported internalizing symptoms, there was a significant univariate total effect of lower IQ predicting greater internalizing symptoms when controlling for youth age, SES, and internalizing symptoms at Time 1. This finding helps clarify existing research on the relationship between IQ and internalizing symptoms in youth with

SB, as one study found no association between these constructs (i.e., Schellinger et al., 2012), while another had (Coakley et al., 2006).

In addition, findings from this study highlight the importance of including data from multiple reporters, as, interestingly, only teacher-reported internalizing symptoms yielded a significant mediation model. It may be that teachers have a different perspective on youth's internalizing symptoms because they are likely to compare individual children with numerous other children in their classroom and school. Teachers may also be in a position to observe internalizing symptoms that occur within a peer context and are linked with one's social competence (e.g., withdrawal from or exclusion by peers). In the current study, teachers reported higher youth internalizing symptoms compared with parents (see Table II), although this was not a significant difference ( $p$  values  $> .05$ ). In addition, it may be that parents are poor reporters of their children's internalizing symptoms (Briggs-Gowan, Carter, & Schwab-Stone, 1996). Indeed, studies have indicated similar discrepancies between caregiver report and self-report of youth with chronic illnesses on measures such as health-related quality of life (e.g., Eiser & Morse, 2001). Given the demands of caring for a child with SB (Holmbeck & Devine, 2010), parents may be more focused on their child's physical health and less tuned in to their emotional health. Furthermore, it is possible that, due to cognitive impairments associated with SB, these youth may lack the higher-level meta-cognitive abilities that are needed to recognize and report their own internalizing symptoms (Wasserman, Holmbeck, Lennon, & Amaro, 2012).

Although this study provides novel information on youth with SB, it has some limitations. First, the neuropsychological data and social competence data were collected at Time 1, which prevents the testing of a truly prospective relationship between these constructs. Having the independent, mediating, and outcome variables measured across three time points would have provided more rigorous inferences about the causal relations implied by such a model (Cole & Maxwell, 2003). Second, the relationship between neuropsychological functioning, social competence, and internalizing symptoms may in fact be bidirectional, whereas the current analyses only examined them unidirectionally. Third, while parent and teacher report of internalizing symptoms came from similar measures (i.e., the CBCL and the TRF), youth report on the CDI provided information only on depressive symptoms and not internalizing symptoms more broadly. Fourth, the social competence composite variable was computed in a way that may have given more weight to the SSRS and Harter measures (see previous explanation of composite in the

Measures section). The authors chose to create it in such a way as to capitalize on the variance provided by each reporter on each measure. Fifth, two of the neuropsychological measures were questionnaire based and may have contributed to the relatively strong relationship found between neuropsychological functioning and social competence. However, the current study was strengthened by the use of longitudinal data, which allowed for the examination of the relationships among constructs over time (Holmbeck et al., 2003). In addition, the current study used multiple reporters and multiple methodologies, which is encouraged in research on pediatric populations because it reduces the possibility of shared-method variance (Holmbeck, Greenley, Coakley, Greco, & Hagstrom, 2006).

Future research will benefit from more fine-grained examinations of the relationships among neuropsychological functioning, social competence, and internalizing symptoms. This could be achieved by, for example, exploring whether certain aspects of social competence (e.g., social skills, friendship quality) are mediators of the relationship between neuropsychological functioning and internalizing symptoms. In addition, other areas of social functioning, such as peer victimization and reduced social interactions due to physical limitations, as well as other aspects of adjustment, such as self-esteem, could be explored. Although the current study found that age did not significantly moderate our results, it would be beneficial to examine developmental trajectories of these associations across adolescence and into young adulthood, given that research suggests these individuals continue to be at risk for psychosocial difficulties as they develop (e.g., Essner & Holmbeck, 2010; Zukerman, Devine, & Holmbeck, 2011). It would also be useful to examine the relationship between neuropsychological functioning, social competence, and internalizing symptoms as moderated by factors such as gender and SB severity. Lastly, future research should investigate the reasons for and implications of informant discrepancies between parents, teachers, and youth (Holmbeck et al., 2002).

In summary, the results of the current study have meaningful implications for parents, teachers, and clinicians serving youth with SB. The current study is important in understanding the relationship between neuropsychological functioning and social competence, such that social competence in youth with SB may be limited by one's neuropsychological functioning. Consistent with previous findings (Landry et al., 1993), our results provide some evidence that youth with SB who have lower levels of neuropsychological functioning may be at risk for social problems and internalizing symptoms. Interventions that

bolster social competence, while being sensitive to the cognitive capacities of youth with SB, could potentially help alleviate or prevent internalizing symptoms in these youth.

### Acknowledgments

The authors would like to thank the Illinois Spina Bifida Association as well as staff of the spina bifida clinics at Lurie Children's Hospital of Chicago, Shriners Hospital for Children-Chicago, and Loyola University Medical Center. We also thank the numerous undergraduate and graduate research assistants who helped with data collection and data entry. Finally, and most importantly, we would like to thank the parents, children, and teachers who participated in this study.

### Funding

This work was supported by grants from the National Institute of Child Health and Human Development (RO1 HD048629) and the March of Dimes Birth Defects Foundation (12-FY13-271). This study is part of an ongoing, longitudinal study.

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