Journal of Pediatric Psychology Advance Access published June 9, 2014

The Influence of Condition Parameters and Internalizing Symptoms on Social Outcomes in Youth With Spina Bifida

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Received January 21, 2014; revisions received May 2, 2014; accepted May 4, 2014

Objective To test a model of social competence in youth with spina bifida (SB). Involvement in social activities was expected to mediate associations between SB-related condition parameters (pain, body mass index, and motor function) and social competence. Internalizing symptoms were predicted to amplify the negative impact of condition parameters on social activity involvement. **Methods** 108 youth with SB, their caregivers, peers, and teachers participated in a multimethod study that included cognitive testing, questionnaires, and observational interaction tasks. **Results** Social activity involvement partially mediated the relation between pain and lower social competence. Internalizing symptoms had a significant indirect effect on social competence via decreased involvement in social activities. **Conclusions** Pain and internalizing symptoms interfere with social activity involvement, which is, in turn, important for social competence development in youth with SB. Assessing and treating these condition parameters and activity factors may be important areas of focus in clinical practice and research with these youth.

Key words anxiety; depression; obesity; pain; social skills; spina bifida.

Social functioning is an important area of research in youth with chronic health conditions, and particularly for youth with spina bifida (SB). Previous research on social functioning in youth with chronic conditions has distinguished between three components of social competence: (1) social adjustment (e.g., peer status, quality and number of friends), (2) social performance (e.g., children's behavior with peers in social situations), and (3) social skills (e.g., the ability to evaluate relevant social cues; Cavell, 1990). Attainment of social competence is a primary task of child and adolescent development (Holmbeck, 2002a) that is linked with adaptive outcomes, such as academic success and moral development (Birch & Ladd, 1996; Cicchetti & Buckowski, 1995; Newcomb & Bagwell, 1998; Parker & Asher, 1993). Unfortunately, the development of social competence may be particularly difficult for youth with neurodevelopmental conditions, such as SB (Cunningham, Thomas, & Warschausky, 2007; Holmbeck et al., 2003; Nassau & Drotar, 1997). Compared with typically developing youth, children and adolescents with SB may have fewer or lower-quality friendships, display socially isolated or withdrawn behavior, and behave passively during social interactions (Blum, Resnick, Nelson, & St. Germaine, 1991; Cunningham, Thomas, & Warschausky, 2007; Holmbeck et al., 2003). Although empirical evidence has consistently shown that youth with SB are at risk for social difficulties, to our knowledge, no study to date has investigated salient condition-related factors (e.g., pain, weight status, and motor function) and emotional factors (i.e., internalizing symptoms) that may negatively impact social development in this population (La Greca, 1990; Nassau & Drotar, 1997). Thus, identifying potential risk factors linked to social competence is an essential step for health professionals committed to enhancing the social functioning of children and adolescents with SB.

Myelomeningocele (MM) is the most common and severe form of SB, and the term MM is often used interchangeably with SB. MM is a congenital condition in which

doi:10.1093/jpepsy/jsu036
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the neural tube fails to close completely during early gestation (Burmeister, Hannay, Fletcher, Boudousquie, & Dennis, 2005), and is associated with motor, orthopedic, sensory, and cognitive impairments that impact youths' functioning across a range of domains (Fletcher & Brei, 2010). The majority of individuals with MM have structural brain abnormalities, such as hydrocephalus and Chiari-II malformation. These brain abnormalities are often associated with a distinct neurocognitive profile (e.g., executive function deficits) that may negatively impact social adjustment (Rose & Holmbeck, 2007).

However, neurological deficits may only partially account for the deficits in social competence observed in youth with SB. The current study was designed to examine a new model of social competence in this population (Figure 1). Although it has been speculated that limited social activity involvement is responsible, to some extent, for the social competence difficulties seen in youth with physical disabilities (La Greca, 1990; Schuman & La Greca, 1999), this connection has not yet been verified by empirical study. Thus, the central premise of the study model is that participation in social activities (e.g., sports, clubs) that involve significant amounts of peer social interaction will provide youth with valuable opportunities to enhance their level of social competence (Figure 1). Social activities provide an important context for peer contact through which children learn social norms (Hansen, Larson, & Dworkin, 2003), develop social skills through interpersonal interactions (La Greca, 1990), and form peer relations that evolve into friendships. Because youth with SB demonstrate limited participation in social activities (Blum, Resnick, Nelson, & St. Germaine, 1991; Stevens et al., 1996), such as school extracurricular activities and organized social activities (Buran, Sawin, Brei, & Fastenau, 2004), their opportunities for meaningful one-on-one peer social interaction are often restricted. Further, beyond neurological impairment, other condition-related factors, including pain, overweight status, and gross motor impairment, as well as emotional factors (e.g., internalizing symptoms), may also influence levels of social competence in youth with SB. Thus, the second component of the current model includes the investigation of a mediation pathway that predicts an association between these condition parameters and decreased social activity participation (Figure 1, Path A), which may then lead to decreased social competence in this pediatric population (i.e., Figure 1, Path B). A discussion of each path, along with the evidence base supporting its role in the overall model, follows.

The first condition parameter, pain intensity, has been understudied in children and adolescents with SB. Recently, pain has been described as more prevalent and more pertinent to psychosocial health in this population than previously believed (Clancy, McGrath, & Oddson, 2005; Oddson, Clancy, & McGrath, 2006). Typical types and mechanisms of acute and chronic pain in these youth include joint and musculoskeletal pain due to overuse, postural factors, and long-term spasticity (Marge, 1994; Sobus, 2008); abdominal pain associated with chronic constipation (Sobus, 2008); lower body pain due to tethered cord; and headache and migraine due to intracranial pressure imbalances and shunt infection or malfunction (Rimmer, Rowland, & Yamaki, 2007; Stellman-Ward, 1997). The negative impact of pain on activity involvement (Figure 1, Path A) has been described in youth with chronic health conditions (Larsson & Sund, 2007; Lemanek, Horowitz, & Ohene-Frempong, 1994; Meijer, Sinnema, Bijstra, Mellenbergh, & Wolters, 2000; Walters & Williamson, 1999), yet this association has not yet been investigated specifically in youth with SB. Further, investigators within the broader literature on child and adolescent chronic pain

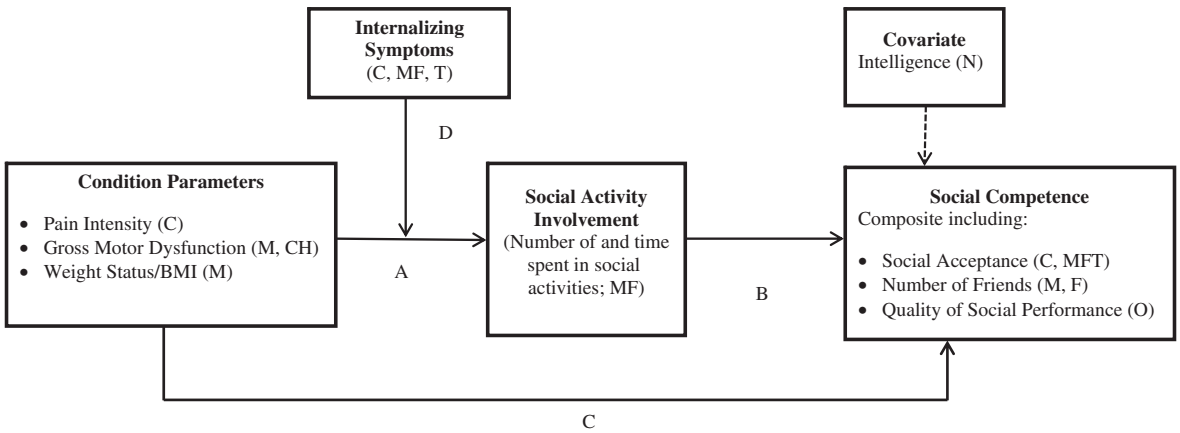

Figure 1. Proposed model examining associations among condition severity, social activity involvement, and social competence in youth with SB.
Note. C = child/adolescent informant; CH = medical chart review; M = mother; F = father; T = teacher; O = observed; N = neuropsychological testing.

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(Palermo, 2000), and more specifically on youth with SB (Larsson & Sund, 2007), have noted that research examining the influence of pain characteristics on social competence is an essential area of research (Figure 1, Path C).

The second condition factor in the model, gross motor dysfunction, has received more attention in the research literature. The majority of individuals with SB have motor impairments that significantly reduce their voluntary movement capacity; thus, they often require assistive mobility devices such as crutches, orthoses, and wheelchairs for ambulation. Whereas some studies have found that severity of mobility limitations has no effect on perceived social acceptance in a variety of chronic health conditions (Meijer Sinnema, Bijstra, Mellenbergh, & Wolters, 2000), others have concluded that greater mobility limitations result in worse social outcomes in this pediatric population (Ammerman, van Hasselt, Hersen, & Moore, 1989). In addition, increased motor dysfunction has been associated with restricted social activity participation in these youth (Figure 1, Path A; Wilson, Washington, Engel, Ciol, & Jensen, 2006). Therefore, it may be that the connection between mobility limitations and social competence deficits (Figure 1, Path C) is best explained via an intervening mechanism, such as reduced social activity involvement (Figure 1, Paths A and B).

The third condition factor, weight status, is highly relevant to youth with SB. However, similar to pain intensity, weight status has received little consideration in empirical investigations of social development in this population. Children and adolescents with SB are at risk for overweight and obesity, with at least 50% of youth over the age of 6 years meeting criteria for obesity (body mass index [BMI] percentile greater than or equal to the 95th percentile) and many more being overweight (BMI percentile between the 85th and 95th percentile; SBA). Excess body weight is generally cited as a major contributing factor to social activity limitations in youth with physical disabilities (Figure 1, Path A; Simeonsson, McMillen, & Huntington, 2002). Further, overweight status may exacerbate the social competence difficulties that are prevalent among children and adolescents with SB (Figure 1, Path C; Rimmer, Rowland, & Yamaki, 2007; Simeonsson, McMillen, & Huntington, 2002). However, to our knowledge, this study will be the first to test associations between overweight status, social activity involvement, and social competence in a more complex model including other important condition parameters.

The final component of the proposed model includes youth internalizing symptoms as a potential moderating factor for social activity limitations, such that higher internalizing symptoms may amplify the negative impact of pain, motor limitations, and BMI percentile (Figure 1, Path D) on social activity involvement. Specifically, condition parameters were expected to more severely limit social activity participation for youth with greater internalizing symptoms. From a biopsychosocial perspective, internalizing symptoms would be expected to moderate the degree to which condition parameters restrict social activity involvement; condition parameters may more severely restrict youths' engagement in social activities, especially in those whose condition is complicated by anxiety and depressive symptoms. For example, there are strong and consistent data that youth with medical conditions (e.g., disease-based and idiopathic chronic pain) who experience higher levels of internalizing symptoms participate less in social activities and have decreased school attendance (Claar & Walker, 2006; Gauntlett-Gilbert & Eccelston, 2007; Peterson & Palermo, 2004). The current study expands this research to youth with SB to examine the interaction between important condition parameters and internalizing symptoms in the prediction of social activity involvement.

Therefore, the aim of the current study was to test a novel theoretical model (Figure 1) in which debilitating condition factors (e.g., greater pain intensity, weight status, and motor dysfunction) would be associated with reduced social activity involvement, which would, in turn, be linked to lower levels of social competence in youth with SB. Specifically, it was hypothesized that: (1) social activity involvement would mediate associations between the three condition parameters and social competence such that greater pain intensity, more severe motor dysfunction, and greater BMI would be associated with lower social competence via the mechanism of reduced social activity involvement; and (2) the condition parameters would have a stronger negative impact on social activity involvement for youth with SB who also had higher levels of internalizing symptoms.

Method

Participants

Participants in this study were recruited for an ongoing, longitudinal study of trajectories of psychosocial adjustment in youth with SB during the transition to adolescence (Devine, Holmbeck, Gayes, & Purnell, 2011). The current study included data from Time 1 of the larger study. Families of children with SB were recruited from three children's hospitals and a statewide SB association. Inclusion criteria for children and adolescents with SB were as follows: (1) diagnosis of SB (including MM, lipomeningocele, and myelocystocele); (2) 8–15 years of age at Time 1;

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(3) ability to speak and read English or Spanish; (4) absence of a comorbid serious chronic medical conditions (e.g., cancer, autism); and (5) residence within 300 miles of the research laboratory. Following initial identification by medical staff, eligible families were notified about the study via mailed recruitment letters, telephone contact, or in-person contact during outpatient clinic appointments. Two hundred forty-six families were approached about study participation. Of these families, 163 agreed to participate; however, 21 families who originally agreed to participate were unable to be contacted or declined at a later time. The final sample for the larger study consisted of 142 families (57% participation rate). Two participants were dropped (yielding a total of 140 participants) because one was too young at Time 1 (7 years old) and the other did not have SB. There were no significant differences between enrolled families and those who declined participation with respect to SB type (i.e., MM vs. other), $\chi^2(1) = 0.0002$, *ns*; shunt status, $\chi^2(1) = 0.003$, *ns*; or occurrence of shunt infection, $\chi^2(1) = 1.08$, *ns*. Children and adolescents with SB ranged in age from 8 to 15 years ($M = 11.54$ years, $SD = 2.45$), with equal numbers of males and females (Table I) and considerable variability in family socioeconomic status (SES). The sample also included a diverse representation of racial and ethnic backgrounds. Hispanic families were oversampled, given the higher rates of SB in this population (Centers for Disease Control and Prevention [CDC], 2013). To restrict the sample to a homogeneous group with similar clinical presentations, the current study sample was limited to the 108 children and adolescents with shunted hydrocephalus (and likewise the most severe SB types) from the larger sample (Table I).

Table I. *Youth Demographics and SB Characteristics*

Demographic variable	$n = 108$ *n* (%) or *M (SD)*
Age	11.5 (2.5)
8–9	28 (25.9)
10–11	22 (20.3)
12–13	29 (26.9)
14–15	29 (26.9)
Sex	
Male	54 (50.0)
Female	54 (50.0)
Race/ethnicity	
White	57 (52.8)
Latino	31 (28.7)
African American	14 (13.0)
Asian	1 (0.9)
Biracial or bi-ethnic	5 (4.6)
SES[a]	39.0 (15.83)
Lesion level	
Sacral	17 (15.7)
Lumbar	69 (63.9)
Thoracic	19 (17.6)
Missing data	3 (2.8)
Number of shunt revisions[a]	3.17 (5.1)

Note. [a]$n = 102$ due to missing data.
SES was measured by Hollingshead Four Factor Index.

Participating families were asked to identify a friend of the youth with SB to participate in several activities. Peer eligibility was dependent on age (i.e., 6–17 years of age and within 2 years ± the age of the child with SB) and the ability to speak and read English or Spanish. Families were strongly encouraged to choose nonrelative friends; however, cousins were permitted to participate if families were unable to identify a friend outside the family. Although the majority of participants were able to invite a nonrelative friend, 15 peers were a sibling, cousin, or other relative. More specifically, 94 of the 108 participants were able to invite a friend who met eligibility criteria from the larger study; 79 of these participants were nonrelatives and 15 were relatives. Because it was recognized that the social interactions between children with SB and family relatives may be qualitatively different than interactions between participants and nonrelative peers (thus affecting social performance ratings on standardized observational interaction tasks), data analyses that included variables based on peer dyadic interactions were conducted utilizing all (i.e., relative and nonrelative) youth–peer dyads ($N = 94$) and then again including *only* youth–peer dyads that were nonrelatives ($N = 79$). This study's findings (i.e., all findings testing study hypotheses reported later) did not differ according to whether relatives were included in the sample. Thus, for all analyses, findings that include the larger sample of 94 youth–peer dyads are reported.

Procedure

This study was approved by university and hospital institutional review boards. Data for the current study were collected by trained graduate and undergraduate students during two 3-hour interviews conducted at the homes of participating families of children and adolescents with SB. Informed consent and assent were obtained from caregivers and child participants before beginning study procedures during the first interview. As part of standardized consenting procedures, parents and children were read a script that described the study and their rights as research participants (which highlighted the voluntary nature of research and their opportunity to decline participation or quit at any time) and asked questions to ensure their understanding before written assent was obtained. Throughout the study visits, children's continued interest

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in participation was frequently assessed and research assistants offered families the opportunity to discontinue, and did so as judged appropriate. Families were asked to provide authorization for researchers to access medical records. Parents were also asked to provide contact information for the teacher who knew their child the best (i.e., with whom their child spent the most time) so that teachers could complete a brief questionnaire about the child's functioning. Caregivers of peers also provided informed consent and peers provided assent.

During the first interview, children and adolescents with SB were administered the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). Caregivers and youth with SB completed a set of questionnaires, and family members participated in a set of standardized interaction tasks that were coded via a macro-coding system (Holmbeck, Zebracki, Johnson, Belvedere, & Schneider, 2007a). During the second home visit, youth with SB and peers participated in a different set of standardized observed interaction tasks, which included: (1) a toy-ranking activity, (2) discussion of an unfamiliar object, (3) discussion and planning of an adventure, and (4) discussion of social conflicts. These tasks were also video-recorded and later coded by research assistants based on a macro-level observational coding system (Holbein, Zebracki, & Holmbeck, 2014) that was similar to the one created to code family interactions (Holmbeck, Zebracki, Johnson, Belvedere, & Schneider, 2007b). Participants received gifts and monetary compensation for their participation.

Measures

Data Reduction

To reduce the number of analyses, and therefore reduce the chance of type I error, when two or more informant reports were available for a given measure, composite scores were created to reduce the number of variables. Bivariate correlations between informants, and mean correlations among all possible informant pairs, were used to examine inter-informant agreement. A bivariate or mean correlation of $r \geq .40$ was used as the criterion for combining measures across multiple informants (Holmbeck, Li, Schurman, Friedman, & Coakley, 2002).

Demographics and Covariates

Caregivers of youth with SB completed a demographic questionnaire that was created for this study. Factors assessed by this questionnaire included child age, ethnicity, parent education levels, and parent occupations. SES was calculated using the Hollingshead Four Factor Index of Social Status (Hollingshead, 1975); this SES score is based on parents' education levels and occupations. Data on SB type, lesion level, and number of shunt revisions were obtained from medical records.

The current study estimated general intelligence based on the Vocabulary and Matrix Reasoning subtests of the WASI (Wechsler, 1999). Given the considerable variability in general intellectual ability among participants with SB in this sample, as well as the established association between verbal IQ and social functioning in youth with SB (Murray, Lennon, Devine, Holmbeck, Klages & Potthoff, 2014), IQ was included as a covariate in all study analyses.

Pain

Pain intensity was assessed via youth report with a Visual Analogue Scale (VAS). Participants marked the point along a 10-cm line that most accurately represented their usual pain severity, with anchors ranging from ''no pain'' to ''worst pain ever.'' Scores were calculated by measuring the distance from the lower end point of the scale to the mark made by the child. A VAS is a commonly used, well-established tool for the assessment of pain intensity in pediatric populations (Cohen et al., 2008). Youth also reported the areas on their body where they most commonly experienced pain during the past 3 months to provide information on common pain locations.

Gross Motor Dysfunction

The Gross Motor Function Classification System for SB (Wilson, Washington, Engel, Ciol, & Jensen, 2006) was adapted for use with children with SB and neuromuscular disease from the Gross Motor Function Classification System for Cerebral Palsy (GMFCS; Palisano, Rosenbaum, Bartlett, & Livingston, 2007; Palisano et al., 1997). The system is based on a youth's degree of self-initiated movement and is designed to capture clinically meaningful distinctions in motor control, with Level I indicating very minimal limitations in gross motor function, to Level V indicating the highest degree of gross motor dysfunction. Motor classification was coded based on information about motor function and mobility from caregiver responses to medical history items and from medical chart data. Coders were trained with actual study cases and all coders achieved predetermined standards for inter-rater reliability (i.e., $\geq$90% agreement rate) during training. Following training, a single coder provided motor classifications for each participant. The original GMFCS scale has demonstrated good inter-rater agreement (Kappa = .75 for children 2 years and older; Palisano et al., 1997).

Weight Status

Weight status was measured using BMI percentile (i.e., weight divided by height squared, plotted on standardized

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gender-specific CDC growth charts; Kuczmarski et al., 2000), which is a commonly used approximation of body adiposity in children and adolescents from ages 2 to 19 years old, and correlates with direct measures of body fat (Mei et al., 2002). For the current study, height and weight were obtained from caregiver report on items from a health questionnaire, which was an abbreviated version of CDC's 1999 Youth Risk Behavior Survey (CDC, 1999). BMI percentile scores for each participant with SB were computed by entering gender, age, height, and weight into the *children's BMI group calculator* (CDC).

Social Activity Involvement

Involvement in social activities was measured utilizing four items from the Activities Competence scale of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). First, mothers and fathers listed up to three sports that their child enjoyed the most, and then indicated three nonathletic social clubs/organizations. Activities that did not have an obvious social component were excluded (e.g., dog walking, mechanics, artifact collecting, books, computer, and TV) from analyses. Parents then indicated how much time their child spent doing each sport or participating in a club/organization that they listed compared with their peers using a 1-to-3 Likert scale (1 = less than average, 2 = average, and 3 = more than average) compared with same-aged peers to determine the *level of participation* in each social activity.

Five analytic steps, developed for the purpose of this study, were implemented to create the final social activity involvement score utilizing parents' responses to these CBCL items. First, mother and father reports of the total number of sports listed were summed separately for each informant (i.e., one to three sports), then mother and father reports of total number of sports were subsequently averaged ($r = .62$ between parents). This same procedure was conducted for mother and father reports of total number of clubs/organizations ($r = .68$ between parents). Second, parent reports of the total number of sports and total number clubs/organizations were combined to create an *average social activities* score ($r = .41$ between activities). Third, mother and father reports of level of participation were averaged for: (1) level of participation in sports and (2) level of participation in clubs/organizations ($rs = .62$ and .68, respectively). Fourth, parent reports of level of participation in sports and level of participation in clubs/organizations were averaged to create an *average level of participation* in social activities score ($r = .52$). Finally, the *average social activities score* and *the average level of participation score* variables were averaged to create the final composite for the child *social activity involvement* score.

Internalizing Symptoms

Parent and teacher responses to items on the Anxious/Depressed and the Withdrawn/Depressed subscales of the CBCL (Achenbach & Rescorla, 2001) were used to assess adults' perceptions of child internalizing symptoms. Youths' internalizing symptoms were assessed with youth report on the Child Depression Inventory (CDI; Kovacs, 1992). This measure assesses 27 symptoms of depression ($\alpha = .81$). Mother and father T-scores of youth internalizing symptoms on the CBCL ($r = .44$) were combined to create a composite score. However, teacher T-scores on the CBCL and youth report on the CDI remained separate due to low correlations with other reporters ($rs = .115$-$.116$ for teacher report; $rs = .12$-$.20$ for youth report).

Social Competence

Social competence in this study was operationally defined according to the Cavell Tri-Component Model (Cavell, 1990), in which social competence is conceptualized as an overarching construct that encompasses social adjustment, social performance, and social skills. Studies of social competence in youth with chronic health conditions, including SB, have tended to focus on constructs that fit within the social adjustment domain of the Cavell model, such as acceptance by peers, social isolation, and number of friends (Nassau & Drotar, 1997). In an effort to capture its complex nature, social competence was created using a composite of two components of the Cavell Model: social adjustment (i.e., peer acceptance and number of friends) and social performance (i.e., observed social performance).

Social acceptance by peers was measured using the six-item Social Acceptance subscale of the Self-Perception Profile for Children (SPPC; Harter, 1985). This measure was completed by children with SB to assess their perception of their own social acceptance by peers. Parents and teachers also completed a three-item version of this scale. Alpha coefficients for youth, mother, father, and teacher report of SPPC were $\alpha = .58$, $\alpha = .75$, and $\alpha = .85$, and $\alpha = .90$, respectively. Although the reliability statistic for youth-reported SPPC was lower than desired, the decision was made to include this scale in the analyses due to the importance of incorporating child report on this construct. Youth with SB's *number of friends* was measured with one item from the CBCL (Achenbach & Rescorla, 2001), in which parents indicated the number of friends that their child has from four response options that provide a numerical range of friends (i.e., none, 1, 2 to 3, 4 or more).

As noted, the social competence composite variable also included a measure of *social performance*. Quality of observed youth social performance was based on data from the video-recorded youth–peer interaction tasks, which

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were coded according to a global coding system created for the larger longitudinal study (Holbein, Zebracki, & Holmbeck, 2014; Holmbeck, Li, Schurman, Friedman, & Coakley, 2002; Holmbeck, Zebracki, Johnson, Belvedere, & Schneider, 2007b). A summary code of overall quality of the social interaction was created by averaging values of the following dyadic codes to generate a single value: (1) degree of mutuality (degree to which family members identify themselves as a dyad with a sense of ''we-ness'' and reciprocity), (2) degree of impairment within the child–peer dyad (reverse-coded; difficulty in responding to the task and how well participants communicate and discuss differences), (3) degree of isolation and/or apathy toward one another (reverse-coded; carrying out task in parallel, without enthusiasm for interaction with task partner), and (4) degree of openness, comfortableness, optimism, and warmth (whether these qualities are present within the interaction). Internal consistency ($\alpha = .92$) and inter-rater reliability (ICC = .85) were acceptable.

Thus, the social competence variable used in analyses comprised a combination of the following seven variables, which were converted to *z*-scores to place all scales on the same metric: mother, father, child, and teacher report of social acceptance; mother and father report of their child's number of friends; and observed quality of social interactions. Due to the high number of variables included in this composite score, internal consistency reliability across the seven variables was assessed (rather than all combinations of bivariate correlations) for the social competence variable. The alpha coefficient was acceptable ($\alpha = .70$).

Data Analyses

Missing Data

The relatively higher rate and nonrandom pattern of missing data in the current data set precluded data imputation procedures for missing data. The most common reason for missing data was the absence of a second caregiver (i.e., there was no father or second caregiver in the family) or teacher-reported data. Because the percentage of missing data (i.e., ratio of items completed to not completed for all possible participants) for any given variable was higher than those that are generally recommended for data imputation (Tabachnick & Fidell, 2013; $M = 16.4\%$ in the current study) and the consistency of data missing from the same source (i.e., second caregiver) resulted in a nonrandom pattern, analyses were conducted with the data available.

Analytic Approach

All data analyses were conducted using Statistical Package for the Social Sciences (SPSS). For tests of mediation, recent guidelines have indicated that the indirect effect is of primary importance; it is not required that the IV → DV effect be significant when testing for the presence of mediation (Zhao, Lynch, & Chen, 2010). Thus, all three possible mediation models (i.e., one of three condition parameters → social activity involvement → social competence) were tested regardless of whether there was a significant effect of the condition parameter on social competence (although the significance of the latter will be reported). Zhao and colleagues have termed mediation in which there is a mediated effect, but not a significant IV → DV effect, an *indirect-only* mediation. The Preacher and Hayes (2008) indirect effects bootstrapping macro was utilized to assess the significance of indirect effects while controlling for IQ. Bootstrapping has been validated in the literature and is preferred over other methods in assessing for the presence of mediation, especially in studies utilizing modest sample sizes (Preacher & Hayes, 2008). This procedure generates an empirical approximation of the product of the estimated path coefficients' sampling distribution (IV → Mediator, Mediator → DV), percentile-based bootstrap confidence intervals (CIs), and bootstrap measures of standard errors using 5,000 resamples, with replacement, from the data set (Preacher & Hayes, 2008). When zero is not contained within the upper and lower bounds of the CI, it can be claimed with 95% confidence that the indirect effect is not zero, indicating a statistically significant indirect effect.

Moderation effects (Figure 1, Path D) were tested according to guidelines described by Aiken and West (1991) and Holmbeck (1997). Prior to conducting the analyses, all independent variables were centered (Aiken & West, 1991; Holmbeck, 2002b), and all two-way interaction variables were created to represent the multiplicative effect of the independent and moderator variables on social activity involvement. To test these moderation effects, three multiple regressions were conducted. Each regression analysis included IQ as a covariate in Step 1, all condition parameter independent variables and one of the moderators (i.e., mother/father, teacher, or child-report of internalizing symptoms) in Step 2, and three two-way interaction terms representing the multiplicative effect of one report of internalizing symptoms and one of the three condition parameters (e.g., teacher report of internalizing symptoms × pain severity) in Step 3.

Results

Preliminary Analyses

Variable distributions were checked for skewness, and if skewed, they were corrected according to procedures

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recommended by Tabachnick and Fidell (2013). Four skewed variables were transformed with a square root transformation: pain intensity, BMI percentile, child report of depressive symptoms, and mother report of youth internalizing symptoms. Two variables required a log transformation: father and teacher report of youth internalizing symptoms. Descriptive statistics for all variables included in study analyses are presented in Table II. Transformed variables were used in analyses; data presented in the table and within the text refer to the original, nontransformed metric. Bivariate correlations between IQ, condition parameters (i.e., pain intensity, weight status, and gross motor dysfunction), social activity involvement, social competence, and internalizing symptoms from all informant sources are provided in Table III.

Descriptive Analyses of Study Variables

General Intelligence

IQ for this sample was in the low average range ($M = 82.09$, $SD = 19.55$), with scores ranging from very low to very superior cognitive abilities. This score range and mean is commensurate with IQ scores typically observed among youth with SB (Willis, Holmbeck, Dillon, & McLone, 1990).

Pain

Pain intensity was reported by youth participants to be low to moderately intense ($M = 3.48$, $SD = 3.22$) with a relatively broad range of pain scores, which are similar to those described in previous studies of youth with SB (Clancy, McGrath, & Oddson, 2005), and are also consistent with ratings by other pediatric chronic illness groups in which pain is considered to be a primary clinical feature (Ilowite, Walco, & Pochaczevsky, 1992). The most common pain locations in youth experiencing pain ($N = 70$) included extremities (37.1%), head (25.0%), abdomen (18.9%), and back (18.2%).

Weight Status

As expected, there was a high rate of overweight and obesity within the study sample (M BMI percentile = 75.77, $SD = 28.47$) with the following weight status distribution: two participants (2.67%) were underweight ($\leq 5^{th}$ percentile), 28 (37.33%) were within the average range (BMI percentile 6^{th}–84^{th} percentiles), 17 (22.67%) were overweight (BMI percentile 85^{th}–94^{th} percentiles), and 28 (37.33%) were obese (BMI percentile $\geq 95^{th}$ percentile).

Gross Motor Dysfunction

In terms of gross motor dysfunction, children and adolescents in this sample ranged from GMFCS ratings of I to IV. Nine participants (8.3%) were classified as Level I (i.e., walks in all settings), 23 (21.3%) as Level II (i.e., walks in most settings and sometimes uses handheld mobility devices for safety or wheeled mobility for long distances), 23 (21.3%) as Level III (i.e., may use handheld mobility device for walking and often use self-propelled manual or powered wheelchair), and 48 (44.4%) as Level IV (i.e., uses a self-operated power wheelchair or is transported by others in a manual wheelchair in most settings). There were no participants classified in Level V. Data required to classify child and adolescent gross motor function were unavailable for five (4.6%) participants. These participants were dropped from analyses involving gross motor dysfunction.

Internalizing Symptoms

Measures of youth internalizing symptoms revealed generally adaptive functioning. Youth, parents, and teachers reported low levels of internalizing symptoms in participants according to the item means on the CDI ($M = 1.31$, $SD = 0.81$, range = 1-3 across reporters) and CBCL T-score means ($M = 55.85$, $SD = 6.12$ across reporters).

Social Activity Involvement

The social activity involvement variable was computed to include (1) the number of sports, (2) the number of social clubs/organizations, (3) youths' level of participation in sports, and (4) youths' level of participation in clubs and/or organizations. According to combined mother and father report, youth with SB participated in about one to two sports and about one club/organization on average ($M = 1.78$, $SD = 1.07$; $M = 0.97$, $SD = 1.00$ respectively). In terms of level of participation, overall, parents indicated that their children participated in both sports and clubs/organizations to a moderate degree ($M = 1.78$, $SD = 0.62$; $M = 2.05$, $SD = 0.48$, respectively). It is important to note that parents were limited to listing up to a total of three sports and three clubs/organizations. Because the CBCL asked parents to indicate those social activities that their child enjoyed the most, the number of social activities included in this social activity involvement variable does not necessarily include *all* activities in which a child may have participated.

Social Competence

Social acceptance by peers was rated among all reporters as generally lower than that of published norms for this measure (Harter, 1985), as indicated by the item mean on the Harter Social Acceptance Scale ($M = 2.76$, $SD = 0.77$ across reporters). Quality of social interaction was observed to be of moderate quality, as indicated by item mean

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Table II. *Scale Means, SDs, aAlphas, and Ranges*

Domain assessed	Variable	*M (SD)* or *n* (%)	Alpha	Range
Covariate				
Intellectual functioning[a]	WASI (standard score)	82.09 (19.55)	–	55–137[k]
Condition parameters (independent variables)				
Pain intensity[b]	VAS	3.48 (3.22)	–	0–10
Gross motor function[c]	I	9 (8.30)	–	I–V
	II	23 (21.30)		
	III	23 (21.30)		
	IV	48 (44.40)		
	V	0 (0.00)		
Weight status[d]	BMI (percentile score)	75.77 (28.47)	–	0.3–99.80[k]
Internalizing symptoms[e] (moderator variable)				
	Child Depression Inventory	*1.31 (0.23)*	0.81	1–3
	CBCL Internalizing Sym (M)	56.33 (6.69)	–	50–74.50[k]
	CBCL Internalizing Sym (F)	54.37 (5.34)	–	50–71.50[k]
	CBCL Internalizing Sym (T)	56.86 (6.33)	–	50–78.50[k]
Social activities involvement (mediator variable)				
Number of activities[f]	Number of sports (MF)	1.76 (1.07)	–	0–3
	Number of clubs/organizations (MF)	0.97 (1.00)	–	0–3
Level of participation[g]	Participation in sports (MF)	1.78 (0.62)	–	1–3
	Participation in clubs/organizations (MF)	2.05 (0.49)	–	1–3
Social competence (dependent variable)				
Social acceptance[h]	SPPC Social Accept scale (C)	2.90 (0.62)	0.58	1–4
	SPPC Social Accept scale (M)	2.71 (0.76)	0.75	1–4
	SPPC Social Accept scale (F)	2.84 (0.80)	0.85	1–4
	SPPC Social Accept scale (T)	2.54 (0.89)	0.80	1–4
Number of friends[i]	Number of friends CBCL item (M)	–	–	1–4
	None	11 (10.2)	0.85	
	1	10 (9.3)		
	2 or 3	41 (38.0)		
	4 or more	29 (26.9)		
	Number of friends CBCL item (F)	–	–	1–4
	None	7 (6.5)	0.90	
	1	11 (10.2)		
	2 or 3	32 (29.6)		
	4 or more	24 (22.2)		
Quality of social interaction[j]	Videotaped Soc. Interact. (O)	3.39 (0.58)	0.92	

Note. For all variables transformed due to skewness, means, *SD*s, and ranges listed in this table refer to pretransformed data.
C = child/adolescent participant report; F = father; M = mother; MF = combined mother and father report (parent report); T = teacher; O = observer. All means were unadjusted (i.e., did not account for covariates). The Child Depression Score was derived using item means.
[a]$n = 102$; [b]$n = 93$; [c]$n = 103$; [d]$n = 75$; [e]$n = 74$-96; [f]$n = 97$; [g]$n = 85$; [h]$n = 75$-94; [i]$n = 74$-91; [j]$n = 92$ due to missing data.
[k]Ranges with this notation indicate highest to lowest values; otherwise values listed for *Range* indicate item ranges.

($M = 3.39$, $SD = 0.58$). The median number of friends reported by mothers and fathers was ''2 or 3.''

Analyses of Study Model

Does Social Activity Involvement Mediate the Association Between Condition Status and Social Competence?

It was hypothesized that social activity involvement would mediate the association between condition parameters (i.e., pain, weight status, and gross motor dysfunction) and social competence (Figure 1). Mediation analyses using the boostrap method yielded a significant indirect effect for social activity involvement in the relation between pain intensity and social competence, such that the association between greater pain and lower social competence was partially explained by decreased social activity involvement (95% CI lower to upper = −.03 to −.003; Figure 2). The type of mediation represented by this pathway was an

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Table III. *Bivariate Correlations Between All Study Variables*

Variable	1	2	3	4	5	6	7	8	9
1. IQ	1.00	−.04	−.17	−.20*	.36*	.32*	−.12	−.23*	−.30*
2. Pain intensity		1.00	−.17	.07	−.29*	−.18	.01	.03	.14
3. Weight status			1.00	.09	−.05	−.27*	.01	.14	.24*
4. Gross motor dysfunction				1.00	−.17	−.14	.13	−.01	−.06
5. Social activity involvement (MF)					1.00	.25*	−.26*	−.28*	−.10
6. Social competence						1.00	−.26*	−.44*	−.18
7. Internalizing (MF)							1.00	.12	.21
8. Internalizing (T)								1.00	.12
9. Internalizing (C)									1.00

*$p \leq .05$.

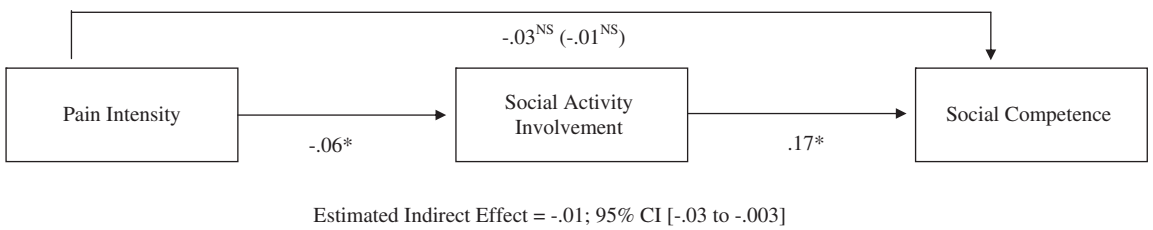

Figure 2. Study model analyses: The association between pain intensity and reduced social competence is mediated by social activities participation in youth with SB.

Note. Path coefficients outside parentheses are estimates of the total effect of pain intensity on social competence, the direct effects between pain intensity to the mediator, and the mediator and social competence. Coefficients inside parentheses are results that include the mediator variable with a direct effect on the criterion. Estimated indirect effects and CIs are results from bootstrapping analyses. All mediation analyses controlled for IQ. *$p < .05$.

indirect-only mediation because there was a significant relation between greater pain intensity and restricted social activity involvement (IV → mediator) and less social activity involvement with lower social competence (mediator → DV), but no significant IV → DV direct effect of greater pain intensity on lower social competence (Table III; Zhao, Lynch, & Chen, 2010). Bootstrapping results for the meditational effect of social activities involvement on the association between weight status and social competence (95% CI lower to upper = −.02 to .01), as well as gross motor dysfunction and social competence (CI lower to upper = −.06 to .01), were not significant.

Do Internalizing Symptoms Moderate the Association Between Condition Parameters and Social Activity?

It was hypothesized that greater pain, weight status, and gross motor dysfunction would predict lower social activity involvement, with stronger effects for youth with greater internalizing symptoms (Figure 1). Results indicated that IQ and pain intensity were significantly associated with social activity involvement in all three regression analyses using three different informant reports of internalizing symptoms (Table IV), with lower IQ (βs = .45 to .47) and greater pain intensity (βs = −.23 to −.22) predicting reduced social activity involvement (*p*s < .05). Parent and teacher report (but not child report) of youth internalizing symptoms emerged as a significant main effect, such that greater internalizing symptoms were associated with reduced activity involvement (βs = −.30 and −.20, respectively, $p < .05$). No significant interaction effects emerged; internalizing symptoms did not moderate the relation between any of the condition parameters and social activity involvement (*p*s > .05; Table IV).

Exploratory Analyses

Does Social Activity Involvement Mediate the Association Between Internalizing Symptoms and Social Competence?

Although internalizing symptoms were not originally proposed as an independent variable in the study model, parent and teacher reports of youths' internalizing symptoms were significantly associated with both the activity involvement mediator variable (Table IV, regression analyses) as well as the social competence outcome variable (Table III, correlations). Thus, exploratory analyses were conducted to test whether social activity involvement

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Table IV. *Regression Analyses for the Moderating Effect of Youths' Internalizing Symptoms on the Association Between Condition Parameters and Social Activity Involvement*

Moderator variable	Step and variable	β	*R*	R^2 Δ	*F* Δ
Mother/father report of youths' internalizing symptoms	1 IQ	.45	.45	.21	16.55**
	2 Pain intensity	−.23	.59	.06	4.97*
	Weight Status	.06	.59	.01	.30
	Motor function	−.07	.59	.01	.33
	MF Internalizing Sx	−.30	.54	.09	7.64**
	3 Pain intensity^x MF Intern Sx	−.10	.55	.01	1.22
	Weight status^x MF Intern Sx	.16	.61	.03	2.47
	Motor function^x MF Intern Sx	−.20	.64	.04	3.41
Teacher report of youths' internalizing symptoms	1 IQ	.47	.47	.22	16.66**
	2 Pain intensity	−.22	.51	.05	3.80*
	Weight status	−.07	61	.00	.01
	Motor function	−.10	.56	.00	.75
	T Internalizing Sx	−.20	.55	.04	3.24*
	3 Pain Intensity^x T Intern Sx	.12	.58	.03	2.53
	Weight Status^x T Intern Sx	.06	.59	.00	.28
	Motor Function^x T Intern Sx	−.18	.59	.01	.83
Youth report of internalizing symptoms	1 IQ	.45	.45	.21	16.74**
	2. Pain intensity	−.22	.50	.05	3.93*
	Weight status	.09	.51	.00	.62
	Motor function	−.09	.52	.00	.74
	Youth Internalizing Sx	−.10	.51	.00	.57
	3. Pain Intensity^x Y Intern Sx	−.04	.53	.00	.11
	Weight status^x Y Intern Sx	−.01	.53	.00	.54
	Motor function^x Y Intern Sx	−.09	.53	.00	.01

*$p \leq .05$; **$p \leq .01$; ^{x} Represents the multiplicative function that was utilized to create interaction terms.

Note. All of the aforementioned analyses were run twice: Once including all participants, and again including only participants with nonrelated peers (i.e., peers could not be siblings, cousins, etc.). Results did not differ, thus the full sample was retained in all subsequent analyses.

mediated the association between teacher-reported and mother-/father-reported internalizing symptoms and social competence. Analyses utilizing the bootstrap method confirmed that the association between both parent and teacher report of greater child internalizing symptoms and lower social competence was partially explained by less social activities involvement. Specifically, the absence of zero in the CIs for the indirect pathways indicated that the indirect effect was significantly different from zero at $p < .05$, two-tailed (95% CI lower to upper = −1.60 to −.04 for teacher report; 95% CI lower to upper = −1.61 to −.11 for combined mother/father report; Figure 3a and b).

Discussion

The aim of this study was to test a new model of social competence in youth with SB, in which involvement in social activities was proposed to be an underlying mechanism for associations between condition factors (e.g., pain, overweight, gross motor function) and social competence. Findings from this study highlight the influence of pain, internalizing symptoms, and social activity involvement on social competence among children and adolescents with SB. Although the cross-sectional nature of this study limits the ability for researchers to draw conclusions related to temporal relations, several of the study findings have implications for clinical practice and provide a foundation for further research in this area.

First, social activity involvement partially mediated the relation between pain and social competence, via an indirect-only mediation effect. Greater pain predicted reduced social activity involvement, which, in turn, was associated with lower social competence in youth with SB. The indirect effect was relatively small, indicating that although statistically significant, this may be only one of several paths affecting social competence for these youth. Given this qualification, these findings bear important weight for stimulating further research and informing clinical practice.

The first path, between pain and social activity involvement, is grounded in the extant literature on the relation between pain and activity restrictions in youth with

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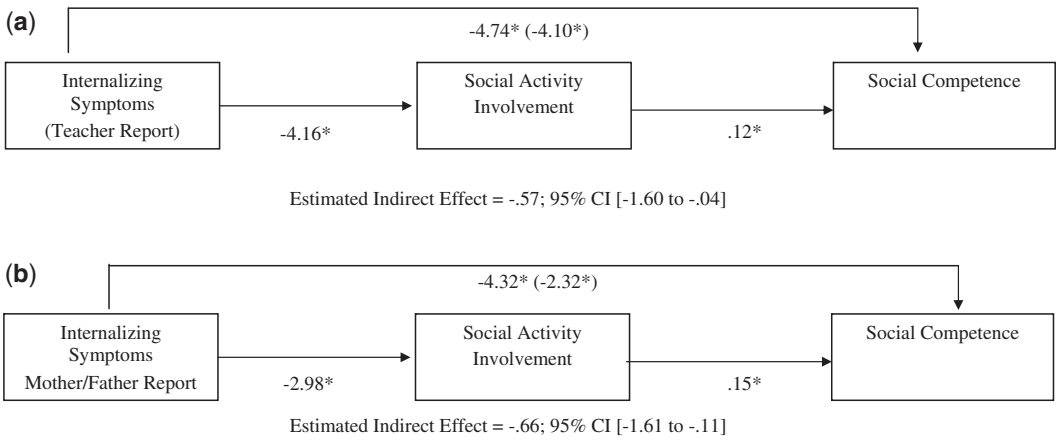

Figure 3. (**a** and **b**) Exploratory analyses: The association between child internalizing symptoms (teacher and mother/father report) and social competence is mediated by social activities participation in youth with SB.

Note. Path coefficients are estimates of the total effect of child internalizing symptoms on social competence, the direct effects between child internalizing symptoms to the mediator, and the mediator to social competence. Coefficients inside parentheses are results that include the mediator variable with a direct effect on the criterion. Estimated indirect effects and CIs are results from bootstrapping analyses. All mediation analyses controlled for IQ. *$p < .05$.

chronic health conditions (Stevens et al., 1996), but, furthermore, highlights the negative impact of pain on activities that have a strong social component. There are likely multiple reasons that youth with SB who have greater pain may limit their social activity involvement. For example, youth might find it difficult to concentrate on conversations and maintain energy levels when they are in pain, and may find the effort needed for social interactions to be so demanding that they withdraw from social activities. Additionally, social activities that have a strong physical activity component (e.g., sports, club-sponsored outings that involve exercise) could exacerbate their pain in the short term, and youth with SB might choose to not participate in these activities for these reasons. Future research should seek to identify the more precise mechanisms for this association between pain and social activity restriction. This preliminary finding could also indicate that pain should be a major component of assessment and treatment for youth with SB. Health care providers who work with these youth should recognize that youth with SB with higher rates of pain are at risk for missing out on important opportunities for peer socialization, which could have indirect consequences for their social competence, as well.

The second path in the model, the significant relation between less social activity involvement and lower social competence, also provides preliminary empirical validation of a link that has been suggested in the literature, but with little evidence. Researchers have generally accepted the notion that limited social activity may be responsible for social competence deficits in youth with physical activities (La Greca, 1990; Schuman & La Greca, 1999). To our knowledge, this is the first study to provide empirical support for the association between social activity involvement and social competence deficits; yet, future longitudinal research is needed to investigate the temporal relations between these factors, which is necessary to support a causal link. Peer-mediated social activities may play an essential role in the development of appropriate social norms and behaviors, including facilitating social skills and increasing the likelihood that children build strong bonds and friendships with their peers who have similar interests. Youth with SB participate in school extracurricular activities and organized social activities at lower rates, thus limiting peer social interactions (Blum, Resnick, Nelson, & St. Germaine, 1991; Stevens et al., 1996). Increasing participation in social activities beginning at a young age may provide an essential foundation for the development of social competence in youth with SB. Additionally, a subset of youth with SB who are more at risk for reduced social activity involvement, such as youth with ongoing pain, may especially benefit from involvement in social activities. Although interventions and participation in therapist-led social groups may facilitate social skill development, pediatric health care providers should also encourage families to engage children in social activities in natural contexts (e.g., school and extracurricular clubs) to provide an environment for children to practice learned skills.

Due to the cross-sectional nature of the study, it should be noted that the direction of these associations could not be determined. Pain may limit a youth's involvement in social activities, as represented in the model tested. Alternatively, having strained peer relationships and relatively low social competence may play some role

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in amplifying a child or adolescent's experience of pain. The availability of longitudinal data will permit the testing of temporal models that may help to explain relationships between pain, social activity participation, and social competence.

Contrary to hypotheses, the current study did not find internalizing symptoms to moderate the association between the condition parameters and social activity involvement. The findings of separate main effects of pain on lower social activity involvement and internalizing symptoms on lower social activity involvement, with no evidence for an interactive effect, indicate that these factors distinctly and uniquely impact youths' activity involvement. Additional supporting data are needed to further support this study's findings, as well as to clarify the unique mechanisms for their roles in restricting social activity for youth with SB. For clinical practice, the finding should emphasize that recognition and management of both symptoms is essential for enhancing social functioning in these youth.

Although study findings did not support the moderating effect of internalizing symptoms in our proposed study model, internalizing symptoms were significantly associated with both social activities involvement and social competence. In fact, an exploratory mediation model indicated that greater teacher and parent report of internalizing symptoms predicted decreased involvement in social activities that, in turn, predicted decreased social competence. Although this main effect was not predicted prior to conducting study analyses, there is evidence for a direct relation between youth internalizing symptoms and activity restrictions from empirical findings in prior studies involving youth with other chronic conditions (e.g., chronic pain; Claar & Walker, 2006; Kashikar-Zuck, Goldschneider, Powers, Vaught, & Hershey, 2002; Logan, Simons, & Kaczynski, 2009). Given that this is the first study to examine the association between internalizing symptoms and social activity involvement in youth with SB, further research is needed to confirm this preliminary mediation model.

Finally, there was no evidence for the hypothesis that social activity involvement would mediate the relation between motor dysfunction and social outcomes, or between weight status and social outcomes. This lack of evidence association between these condition parameters and lower social activity involvement is unexpected, given that similar condition parameters have been cited as major contributing factors to social activity limitations in children and adolescents with physical disabilities (Simeonsson, McMillen, & Huntington, 2002). However, the methodology for this study might have contributed to these null findings. The social activities participation variable used in the current study required that caregivers name social activities that youth typically perform, and did not include an assessment of limitations or disruptions in day-to-day activity on a broader level (as a measure of functional disability would). Thus, weight status and gross motor dysfunction might have a more significant impact on a child's overall functional ability, and may have a lesser impact on involvement in social activities. Further, because individuals with physical disabilities have much lower base rates of physical activity as compared with typically developing youth, these populations might require a specialized assessment tool, with different items and separate norms. Psychometrically sound tools for the measurement of social activity limitations and functional disability in youth with physical disabilities is an area in need of further development.

A major strength of this study was the inclusion of measures of pain intensity and weight status. These condition parameters are relatively understudied in studies examining condition severity and psychosocial development in youth with SB. Another strength of the current study was the ethnic and socioeconomic diversity of the sample, which was relatively large by pediatric psychology research standards (La Greca & Shuman, 1999). In addition, the use of multiple informants and multiple measures, as well as the inclusion of observational data, enhanced the validity and generalizability of our study. Finally, the current study attempted to measure the broad, overarching construct of social competence based on a strong theoretical model (i.e., Cavell, 1990), including indices of both social adjustment and social performance in the composite. Thus, the current study expands research on social functioning among children and adolescents with SB, which has almost exclusively focused on variants of the social acceptance domain, while excluding other important aspects of social competence (Nassau & Drotar, 1997).

Although this study featured several strengths, several limitations should be noted. This study was conducted with cross-sectional data and, thus, study results should be regarded as providing promising, but only preliminary, support for the proposed model in which individual components (rather than the full model) were tested. Because cross-sectional data do not permit an examination of the direction of effects, cross-sectional mediation analyses may overestimate the strength of effects, as compared with what would be obtained with longitudinal data (Maxwell & Cole, 2007). In addition, future studies should explore other methodologies for assessing the breadth and types of activities or depth of involvement that are important aspects of social activity participation. For example, our measure of social activity involvement did not include

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the full range of sources for social interaction that may be particularly relevant for children with physical disabilities with access barriers to sports/club participation, such as Web-based or phone communication (e.g., Facebook, texting). The use of a broad-band measure of internalizing symptoms for parent and teacher proxy reports, and child report of depressive symptoms, is not ideal, and could have confounded findings for the different reporters in this study. Finally, the internal consistency of the child report of social acceptance could have limited findings involving the social competence variable, as well.

Although it is a strength that the current study controlled for the effects of general intellectual abilities by including a brief estimate of IQ as a covariate in all analyses, future research may consider the use of other important neuropsychological measures in studies of youth social competence attainment, such as more comprehensive IQ measures (with separate verbal and nonverbal ability assessments), inattention/impulsivity, and executive dysfunction. On the other hand, it is important to consider that certain underlying neurological mechanisms may impact both IQ and condition parameters in this population. Additionally, our age range (8-15 years) is wide and crosses several developmental stages. Although the proposed model was intended to capture pathways to social competence that unfold among youth across this entire age range, developmental theory (Bagwell & Schmidt, 2013; Furman & Buhrmester, 1992) would suggest that peer social activity involvement would be more salient in the formation of social competence for mid-to-late adolescents than for children and early adolescents, for whom parents maintain greater influence over social development. Further elucidation of this model, including the differential role of social activity involvement in shaping social competence across youth of different developmental levels, should be addressed in future research with samples large enough to support age-specific analyses.

Family SES may impact youth social activity involvement by limiting practical and financial resources to support participation in sports and clubs. Although it is beyond the scope of this study to examine the impact of SES on social activity involvement, this could be considered in future studies. Further, BMI percentile was derived from mother report of their child's height and weight. Obtaining these measurements through objective assessment would offer a stronger assurance of the validity of these data. Finally, although an effort was made to reduce the number of analyses by combining multiple measures of the same construct across informants and across data formats, several mediation analyses were conducted, which increased the chance of type I errors.

Future research should build on this study by continuing to investigate the complex relations among condition parameters, social activity involvement, and social competence in children and adolescents with SB. Additional work is needed to confirm initial, cross-sectional findings and further elucidate paths between condition-related factors and psychosocial outcomes. Information gained from this important area of research has the potential to greatly enhance clinical practice. Interventions that incorporate modules to help reduce symptoms of pain and internalizing symptoms, encourage weight management, and highlight the importance of participation in organized social activities outside of the therapeutic setting may be particularly important to help youth develop better social competence. By gaining further information about the role of modifiable condition factors and internalizing symptoms in disrupting social activity participation and social competence, researchers will be able to identify appropriate targets for intervention and enhance the social functioning of children and adolescents with SB.

Funding

Completion of this manuscript was supported in part by grants from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (R01 HD048629) and the March of Dimes Birth Defects Foundation (#12-FY13-271). This study is part of an ongoing, longitudinal study.

Conflicts of interest: None declared.

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