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Trajectories of Psychosocial Adjustment in Adolescents With Spina Bifida: A 6-Year, Four-Wave Longitudinal Follow-Up

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Objective: As a follow-up to an earlier cross-sectional study (Holmbeck et al., 2003), the current multimethod, multi-informant investigation examined individual growth in psychosocial adjustment across the adolescent transition in 2 samples: young adolescents with spina bifida (SB) and typically developing adolescents ($N = 68$ in both groups at Time 1). ***Method:*** Growth curve modeling procedures were used to describe the developmental course of psychosocial adjustment across 4 waves of data collection from ages 8 to 15. Child gender was included in the models as a moderator of associations between illness status and adjustment trajectories. ***Results and Conclusions:*** Findings revealed that preadolescent differences between groups were maintained for several adjustment variables, indicating that adolescents with SB have enduring academic and attention problems and difficulties with social development (e.g., fewer friends and less influence during family interactions). For other outcomes, trajectories of adjustment levels for adolescents with SB converged on levels observed in comparison adolescents, indicating some areas of resilience. Girls with SB were at risk for increasing levels of social difficulties and negative perceptions of their physical appearance. Clinical implications are discussed.

Keywords: spina bifida, psychosocial adjustment, growth analyses, adolescence

Past research suggests that children and adolescents with chronic physical conditions are more likely to exhibit psychosocial adjustment difficulties than are typically developing children and adolescents (e.g., internalizing symptoms; Holmbeck et al., 2003; Lavigne & Faier-Routman, 1992). Such findings have been replicated across studies with large heterogeneous samples of children presenting with a variety of illnesses (i.e., noncategorical studies; Stein & Jessop, 1982) and in studies focused on single conditions (i.e., categorical studies). Most of the studies conducted thus far, however, have employed cross-sectional designs that fail to incorporate a developmentally oriented conceptualization of psychosocial adjustment. Specifically, we know little about how psychosocial adjustment changes over time during critical developmental periods in these populations or whether certain developmental periods are particularly challenging for children with chronic physical conditions (Cicchetti & Rogosch, 2002). Thus, as a follow-up to an earlier cross-sectional study (Holmbeck et al., 2003), this study examined trajectories of psychosocial adjustment during the transition to adolescence in children with spina bifida (SB) and in a matched comparison sample of adolescents without a chronic illness.

SB is a relatively common congenital neural tube defect, affecting roughly 18 of every 100,000 live births (Centers for Disease Control, 2008). It is caused by a failed closure of the neural tube during pregnancy; children with this condition are born with a spinal lesion and characteristic brain malformations. Associated health complications include weakened or paralyzed lower extremities, urinary and bowel incontinence, hydrocephalus, and learning difficulties. The severity of SB

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varies in accordance with the spinal lesion level and the presence of neurological complications.

Although some cross-sectional studies of psychosocial adjustment in children and adolescents with SB have found few differences between children with SB and comparison samples or normative data, others have found group differences (see Holmbeck et al., 2003, and Shields, Taylor, & Dodd, 2008, for reviews). In studies where differences have emerged, children with SB tended to exhibit higher rates of internalizing symptoms, lower self-esteem, less social competence, more academic difficulties, and problems with executive functions and the ability to focus attention. In a cross-sectional, multimethod, and multi-informant investigation of psychosocial adjustment in preadolescents with SB (8–9 years of age), Holmbeck et al. (2003) found that children with SB, in comparison to typically developing children, tended to be socially immature and passive, less likely to have social contacts outside of school, more dependent on adults for guidance, less competent scholastically, less likely to make independent decisions, and more likely to exhibit attention problems. The current report provides a developmentally oriented longitudinal follow-up to this earlier effort.

The transition to adolescence has been characterized as a critical period for the development of psychosocial skills and a time when health-related behaviors are consolidated and have implications for disease outcomes during adulthood (Holmbeck, 2002; Holmbeck, Friedman, Abad, & Jandasek, 2006; Williams, Holmbeck, & Neff Greenley, 2002). Given the many changes that characterize adolescent development (Feldman & Elliott, 1990), it is not surprising that there are also significant changes in the type and frequency of psychological symptoms and problem behaviors that are manifested during adolescence, compared with childhood. Adolescence is a period of development when a maladaptive pathway may be altered in an adaptive direction by exposure to protective processes or interventions; similarly, maladaptive pathways may originate anew during this period (Cicchetti & Rogosch, 2002).

With respect to adolescent adjustment outcomes, we included measures of adjustment that fell into three domains common in child adjustment research: (a) perceived competence (social acceptance, scholastic competence, physical appearance); (b) symptomatology (internalizing behavior, externalizing behavior, attention problems); and (c) observed child behavior (child engagement in family interaction, quality of affect, degree of influence or control during family interaction, and conflict behavior). With respect to the observed behaviors, we sought to examine broad areas of child behavioral functioning within the family context. Constructs such as affect, control, conflict, and engagement are fundamental familial behaviors that are frequently examined in studies of family interaction (Cox & Brooks-Gunn, 1999; Kerig & Lindahl, 2001) and in the family therapy literature (Walsh, 1993).

In keeping with a developmental perspective, we sought to examine the differential utility of four competing models for how children with SB might differ from typically developing children with respect to changes in trajectories of psychosocial adjustment during the transition to adolescence (see Figure 1). First, as noted above, these groups were found to differ on several adjustment outcomes when they were 8 or 9 years old (Holmbeck et al., 2003). Thus, it is possible that these differences would be maintained over time across these two groups. Such differences might be maintained in one of two ways. Both groups might exhibit flat slopes over time with no change in the level of adjustment over time for either group (see first panel in Figure 1A). Alternatively, both groups might change with equivalent slopes whereby group differences are maintained (see second and third panel in Figure 1A). Consistent with the concept of continuity from the field of developmental psychopathology (Cicchetti & Rogosch, 2002) and findings regarding the stability of attention problems over time (Barkley, 2006), we predicted that attention problems would yield findings most consistent with the left-most panel in Figure 1A, with participants from the SB group showing higher levels throughout the adolescent period. Other outcomes were expected

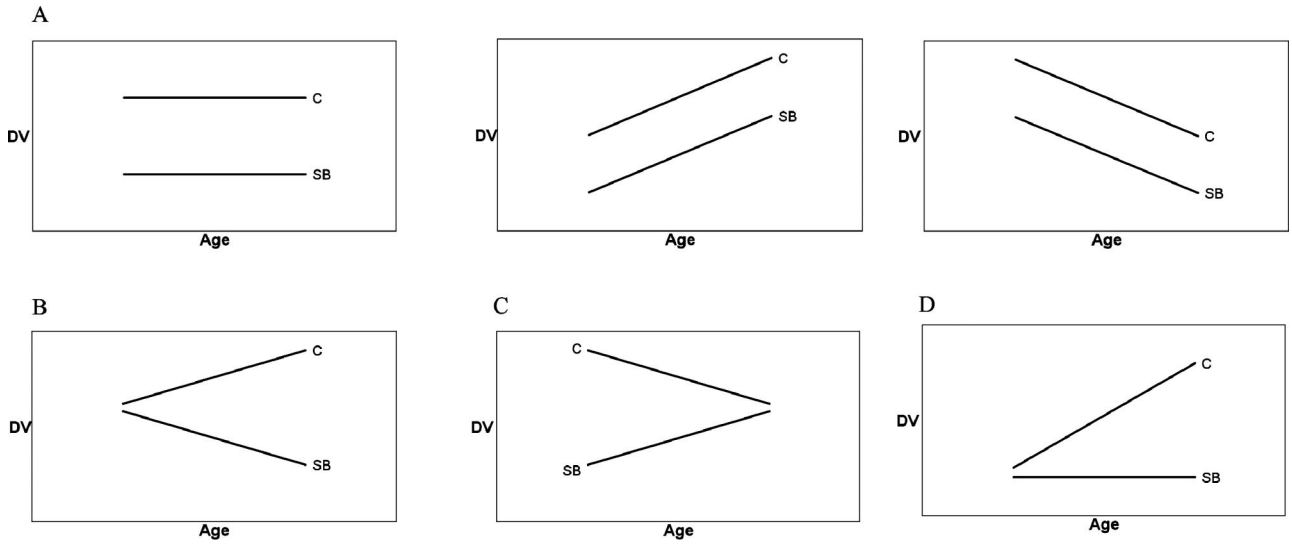

Figure 1. Models of growth trajectories for children with spina bifida (SB) and typically developing children (C = comparison sample; DV = dependent variable). A: Similar longitudinal trajectories with maintenance of group differences. B: Divergence with increasing group differences. C: Convergence with decreasing group differences. D: Divergence with no change in SB trajectory.

to yield findings similar to the other two panels in Figure 1A. Levels of depressive symptoms were expected to accelerate and levels of observed positive affect were expected to decrease similarly in both samples throughout the adolescent period (Garber, Keiley, & Martin, 2002), with the comparison group expected to exhibit higher levels of positive affect and lower levels of depression across time. Similar acceleration effects were expected for observed child influence in family interactions, with comparison children exhibiting higher levels (Holmbeck et al., 2003). Finally, deceleration in perceived scholastic competence was expected in both groups (with higher levels in the comparison group), consistent with findings regarding the stressful transitions to middle school and high school (Simmons & Blyth, 1987).

Second, because of stresses related to managing an illness during a period of rapid developmental change, it may be that children with SB would exhibit increases in adjustment difficulties at a more rapid rate than typically developing children, thus leading to an increase or divergence in the adjustment differences between groups (see Figure 1B). Specifically, we expected that findings for social acceptance and perceived physical appearance would be consistent with Figure 1B. Children from the comparison sample were expected to exhibit increases in social acceptance, number of friends, and perceived physical appearance over time, but children with SB were expected to exhibit declines in these areas, given the increasing complexity of social interactions during the adolescent developmental period (Brown, 1990).

Third, although children with SB exhibit psychosocial difficulties in early development, they may "catch up" gradually over time. If this is the case, we would expect to find a reduction in the magnitude of group differences as the trajectories for the SB group converge on the trajectories for the comparison sample (see Figure 1C). Findings for engagement in family interaction were expected to be consistent with the pattern displayed in Figure 1C. Comparison adolescents were expected to become gradually less engaged in family interactions (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996), but adolescents with SB were expected to overcome higher levels of passivity exhibited at earlier ages (Holmbeck et al., 2003) and become more engaged in family interaction as their social skills develop.

Fourth, in some of our earlier work, we found a tendency for parents to respond less to developmental change (e.g., pubertal change) in families of children with SB than in families of typically developing children (Coakley, Holmbeck, Friedman, Greenley, & Thill, 2002). If this finding also applies to changes in psychosocial adjustment, we might find that there is relatively little change over time in levels of adjustment during the transition to adolescence in children with SB (i.e., flat slopes) but that there is significant change in typically developing children (rapidly increasing or decreasing slopes; see Figure 1D). Similarly, in cases involving adjustment problems, the presence of SB may be protective against increases in adjustment difficulties that ordinarily occur in typically developing adolescents (see Figure 1D). Indeed, we expected that findings for externalizing symptoms would be most consistent with Figure 1D, given the low rates of externalizing symptoms in those with SB (Holmbeck et al., 2003) and the normative increases in externalizing symptoms one would expect in typically developing children during the adolescent years (McMahon & Kotler, 2006).

This study addressed limitations of past work in several ways. First, the study included observed family interaction data as well as questionnaire data from multiple informants (mothers, fathers, and children). Second, the study was longitudinal and included four waves of data collection, thus making growth curve analyses possible. Third, a carefully matched comparison sample of typically developing children was examined in comparison to children with SB. Finally, we sought to examine the moderating role of gender for associations between illness status (SB vs. comparison) and trajectories of adjustment (Holmbeck, 1997). Past gender-based research has indicated that identity development in male adolescents appears to involve struggles with autonomy and themes of separation, whereas identity development in female adolescents is more likely to be intertwined with the development and maintenance of intimate relationships (Galambos, Almeida, & Petersen, 1990; Gilligan, Lyons, & Hanmer, 1990). Such findings are in line with the gender intensification hypothesis (Hill & Lynch, 1983), insofar as there is an intensification of gender-related role expectations during adolescence. Given the likely relevance of autonomy-related struggles and intimacy issues for adolescents with SB (Holmbeck et al., 2003), we expected such gender-related role expectations to be particularly salient for children with SB. In fact, in a recent article from our own laboratory, Friedman, Holmbeck, DeLucia, Jandasek, and Zebracki (2009) found that boys with SB, compared with their typically developing peers, were particularly at risk for delays in autonomy development. Thus, we expected that girls with SB would be particularly likely to experience escalating difficulties with social acceptance and perceived physical appearance.

Method

Participants

Participants in this study were part of a larger longitudinal investigation of psychosocial adjustment and family relationships during the transition to adolescence in children with SB (e.g., Holmbeck et al., 2003). During the first data collection period (Time 1), 68 families with children 8 or 9 years old who had SB were interviewed [37 boys, 31 girls; M(age) = 8.34; see Table 1]. The comparison sample was matched at the group rather than the individual level and consisted of 68 families with a typically developing child [37 boys, 31 girls; M(age) = 8.49]. The initial focus on 8- and 9-year-olds permitted the collection of baseline data prior to the beginning of the transition to adolescence. A wide range of family incomes was represented in both samples. The majority of participants were White (91% in the comparison group; 82% in the SB group). Although biological mothers from all families from both groups participated in the study, only 55 (81%) of the fathers or stepfathers from the SB group and 52 (76%) of the fathers or stepfathers from the comparison group participated. Participants from the SB and comparison groups were matched at the group level on the following demographic variables: child age, maternal age, paternal age, child gender, child ethnicity, birth order, marital status, family socioeconomic status (SES), maternal report of family income, and paternal report of family income (see Table 1).

Data collection for the larger longitudinal study occurred every 2 years. The present study examined psychosocial adjustment

Table 1
Demographic Characteristics at Time 1, by Illness Status

Variable	Spina bifida (n = 68)		Comparison (n = 68)		Statistics
	M	*SD*	*M*	*SD*	
Continuous variables					
Child age	8.34	0.48	8.49	0.50	$t(134) = -1.75$
Maternal age	37.74	5.19	37.74	4.84	$t(134) = 0.00$
Paternal age	41.02	5.45	40.63	6.50	$t(105) = 0.33$
Child birth order	2.12	1.38	2.06	1.29	$t(129) = 0.27$
Maternal income	5.75	2.57	5.73	2.45	$t(130) = 0.05$
Paternal income	6.24	2.50	6.35	2.22	$t(105) = -0.24$
Hollingshead SES	43.12	10.57	46.46	10.89	$t(131) = -1.80$
Categorical variables	*n*	%	*n*	%	
Child gender (female)	31	45.59	31	45.59	$\chi^2(1, N = 136) = 0.00$
Child ethnicity (White)	56	82.35	62	91.18	$\chi^2(1, N = 136) = 2.30$
Parent marital status (two-parent intact)	55	80.88	47	69.12	$\chi^2(1, N = 136) = 2.51$

Note. Family income was rated on a scale from 1 to 11 (1 < $10,000; 5 = $40,000–49,999; 10 = $90,000–99,999; and 11 > $100,000). The Hollingshead (1975) four-factor index of socioeconomic status (SES) was based on a composite of maternal education, paternal education, maternal occupational status, and paternal occupational status. Child ethnicity is a dichotomous variable (White, Other), and parental marital status is a dichotomous variable (two-parent intact, nonintact). All statistics were nonsignificant.

through the first four waves of data collection. At Time 1, children in the sample were 8 or 9 years old; at Time 4, the adolescents in the sample were 14 or 15 years old. The total sample completing both Time 1 and Time 2 interviews consisted of 67 families of children with SB and 66 families in the comparison group, with a retention rate of 99% for the SB group and 97% for the comparison group. Sixty-four families in the SB group (94%) and 66 in the comparison group (97%) participated at Time 3. Finally, 60 families in the SB group (88%) and 65 families in the comparison group (96%) participated at Time 4.

Participating families in the SB group were recruited from lists provided by four sources: (a) a children's hospital, (b) a pediatric specialty hospital, (c) a university-based medical center, and (d) a statewide SB association. A recruitment letter was sent to all parents of children within the 8- to 9-year-old age range (and those who would reach this age within the following year). Out of 310 nonoverlapping child names from the four sources, 72 families lived too far away (more than 120 miles from the laboratory), 64 declined to participate, 56 could not be reached (due to invalid addresses and phone numbers), 16 did not speak English, 14 children had turned 10 years old before a visit could be scheduled, 11 children did not have SB, and seven were excluded for miscellaneous reasons. Seventy families remained. A comparison of participating children (n = 70) with children from families that declined to participate (n = 64) revealed no differences with respect to lesion level, $\chi^2(2, N = 134) = 0.62$, $p > .05$, or type of SB (myelomeningocele vs. lipomeningocele), $\chi^2(1, N = 134) = 1.63$, $p > .05$.

Participants in the comparison group were recruited by contacting schools where the participating children with SB were enrolled. It proved unnecessary to contact all possible schools to obtain a comparison group the same size as the SB group. Instead, a representative listing of schools was chosen on the basis of the following factors: location, the average family income of the surrounding community, and the ethnic distribution in the school. The initial list of schools was based on school enrollment information for the first 42 children with SB who agreed to participate in our study. Of these, 24 schools were ruled out (e.g., the community was too far away to run multiple families in that community given limited funding resources; there was a racial distribution in the school that would have produced matching difficulties). Of the remaining 18 schools, 12 agreed to participate and six declined. To obtain the sample used in this study, we distributed roughly 1,700 letters to schools; children were asked to bring the letters home and request parental permission to participate. Seventy-two families agreed to participate. The low recruitment rate is attributable, at least in part, to the longitudinal nature of the study that was described in detail in the recruitment letter.

Matching of the samples on the 10 demographic variables was achieved at the group level. In other words, specific individuals in one group were not matched (demographically) to specific individuals in the other group. Initially, a demographic comparison of the original samples (ns of 70 and 72 in the SB and comparison samples, respectively) revealed sample differences ($p < .05$) on three of the 10 demographic matching variables (child age, SES, and child ethnicity). Families who were most discrepant from the mean of their subsample were dropped until matching was achieved on all 10 variables. Thus, two families from the SB sample and four families from the comparison sample were dropped from the analyses to facilitate group-level matching and to achieve equal sample sizes (n = 68) in each group.

At Time 1, information on a number of physical status variables for the SB group was obtained on the basis of maternal report or from information gleaned from the child's medical chart: (a) spinal lesion level (medical chart): 32% sacral, 54% lumbosacral or lumbar, 13% thoracic; (b) SB type (medical chart): 82% myelomeningocele, 12% lipomeningocele, 6% other; (c) shunt status (maternal report): 71% shunt, 29% no shunt; and (d) ambulation (maternal report): 19% no assistance, 63% assistance with braces, 18% assistance with a wheelchair. The average number of shunt

surgeries prior to Time 1 among those with shunts was 2.50 (SD = 2.91). As expected (Wills, Holmbeck, Dillon, & McLone, 1990), a significant difference was found between the samples on a measure of receptive language at Time 1 (Peabody Picture Vocabulary Test, Revised; PPVT-R; Dunn & Dunn, 1981): M = 92.49 (SD = 18.49) for the SB sample and M = 108.97 (SD = 15.06) for the comparison sample.

Procedure

Data for each wave of the study were collected during 3-hr visits to each family's home by trained graduate and undergraduate psychology students. After parents and children signed consents and assents, respectively, the family members completed several questionnaire packets and a series of videotaped family interaction tasks. Parents were also asked to sign a release of information form for a medical chart review.

For all four waves of data collection, the following three videotaped family tasks were coded (the order of which was counterbalanced across families; Holmbeck, Belvedere, Gorey-Ferguson, & Schneider, 1995): an unfamiliar board game task (developed for this study), a conflict task (Smetana, Yau, Restrepo, & Braeges, 1991), and the Structured Family Interaction Task (Ferreira, 1963).

For the unfamiliar board game task, families were asked to play an educational game purchased through a mail order catalog (not available for retail purchase); a different game was used for each data collection wave. The conflict task was based on a procedure employed by Smetana et al. (1991). Family members were asked to select three of five issues and discuss them for a total of 10 min; the five issues were selected by the research assistants after computing weighted conflict scores derived from parent and child report on the Issues Checklist (Robin & Foster, 1989). Finally, families completed the Structured Family Interaction Task (Ferreira, 1963). During the questionnaire portion of the home visit, each parent and child completed a five-item questionnaire, each item of which contained five response options. Respondents recorded their first and second choices for commonly discussed family issues (e.g., what TV show they would watch). During the videotaped family interaction portion of the home visit, the family was again given a copy of this questionnaire and was asked to come to a group consensus and select a first and second choice for the same items.

Demographic Measures

At each session, parents reported on various domains of demographic information, including child age and SES. Hollingshead's (1975) four-factor measure of SES was employed as a covariate in all analyses. A continuous measure of child age in years was computed for each wave using the child's birth date and the date of the interview; this measure was used as the time variable in the growth curve models.

Measures of Receptive Language

The PPVT-R (Dunn & Dunn, 1981) was employed as a measure of receptive vocabulary and was used as a proxy for verbal IQ. Given the group difference on the PPVT-R noted earlier, this measure was included as a covariate in all data analyses.

Measures of Perceived Competence

Scholastic Competence. The Scholastic Competence subscale from the child and parent versions of Harter's (1985) Self-Perception Profile for Children (SPPC) scale was used to assess scholastic functioning. Within the SB group and across the four data collection time points, alphas ranged from .71 to .86 (M = .78) for child report, from .81 to .88 (M = .84) for mother report, and from .78 to .85 (M = .82) for father report. Within the comparison group, alphas ranged from .70 to .90 (M = .82) for child report, from .79 to .84 (M = .81) for mother report, and from .69 to .81 (M = .75) for father report.

Social Acceptance. The Social Acceptance scale from the child and parent versions of Harter's (1985) SPPC scale was used to assess social acceptance by peers. Within the SB group, alphas ranged from .68 to .81 (M = .74) for child report, from .78 to .89 (M = .84) for mother report, and from .66 to .84 (M = .76) for father report. Within the comparison group, alphas ranged from .63 to .87 (M = .77) for child report, from .76 to .95 (M = .86) for mother report, and from .68 to .92 (M = .82) for father report.

Mother report on the following item from the Child Behavior Checklist (CBCL; Achenbach, 1991) assessed the child's number of friends and was used to evaluate social acceptance: "About how many close friends does your child have?" Response options were "none," "1," "2–3," and "4 or more" and were coded as 1–4.

Perceived Physical Appearance. Perceived Physical Appearance was assessed with child report on the SPPC (Harter, 1985). Within the SB group and across the four data collection time points, alphas ranged from .74 to .88 (M = .80) for this subscale. Within the comparison group, alphas ranged from .77 to .89 (M = .84).

Measures of Symptomatology

Adjustment variables are listed within the following domains: internalizing symptoms, externalizing symptoms, and attention problems.

Internalizing symptoms. Mother and father reports on the Anxious/Depressed subscale of the CBCL (Achenbach, 1991) and child report on the 27-item Children's Depression Inventory (CDI; Kovacs, 1992; a measure that allows children to select among alternatives on a 3-point scale reflecting the degree of depressive symptomatology) were employed as measures of internalizing symptoms. Within the SB group, alphas for the CDI ranged from .77 to .83 (M = .81). Within the comparison group, alphas ranged from .78 to .87 (M = .83).

Externalizing symptoms. Mother and father report on the second-order externalizing scale from the CBCL (Achenbach, 1991) were employed as a measure of externalizing symptoms. This scale includes items from the Delinquent Behavior and Aggressive Behavior first-order subscales. The Behavioral Conduct scale from the child version of Harter's (1985) SPPC scale was used to assess child-reported externalizing symptoms. Higher scores represented more positive behavioral conduct. Within the SB group, alphas for the behavioral conduct scale ranged from .57 to .88 (M = .77); within the comparison group, alphas ranged from .71 to .88 (M = .83).

Attention problems. Mother and father reports on the Attention Problems subscale of the CBCL (Achenbach, 1991) were used. Items in this subscale are independent of those comprising the CBCL internalizing or externalizing second-order scales.

Observational Measures of Adolescent Behavior During Family Interaction

The three family interaction tasks were coded using a global coding method developed by Holmbeck et al. (1995), which was based on a system devised by Smetana et al. (1991). As is typically done with global coding systems, coders viewed an entire family interaction task and then provided 5-point Likert scale ratings on a variety of dimensions that assess child, parent, and family behavior (for a total of 82 codes). The manual includes behavioral descriptions for each of the points along the Likert scale. All items were rated by two coders for all three tasks across all families. The coders were undergraduate- and graduate-level research assistants who received at least 10 hr of training prior to beginning the coding process. With respect to the codes that focus exclusively on child behavior (i.e., 15 codes from larger set of 82 codes), the following dimensions were assessed in the present study: (a) level of engagement during the family interaction (five codes); (b) conflict behavior (three codes); (c) positive affect (five codes); and (d) power/control (two codes). Within the SB group, scale alphas ranged from .51 to .90 ($M = .73$) across the first three scales (alphas were not computed for the two-item power/control scale). Within the comparison group, scale alphas ranged from .70 to .89 ($M = .82$). Given that power/control only contained two items, Pearson *r*s were computed between the two items. For the SB group, *r*s ranged from .34 to .56 ($M = .45$); for the comparison sample, *r*s ranged from .25 to .43 ($M = .32$). In general, satisfactory interrater reliability was found for each of these four scales (including the power/control scale) across the four time points. Specifically, with one exception, intraclass correlations (Suen & Ary, 1989) ranged from .64 to .83 ($M = .75$) in the SB sample and from .65 to .85 ($M = .77$) in the comparison sample. For conflict behavior, the rater reliability value at Time 3 for the SB sample was .23; thus, this scale was dropped from the analyses below.

Results

Forming Parent Composite Measures

To reduce the number of models described below, we created parent composites for all relevant outcomes (except "number of friends," which was based on a single mother-reported item). Composites were formed at the level of assessment wave; responses were averaged when both mother- and father-reported data were present. If data from only a single reporter (e.g., mother) were present, those data were used. Across all data points, the averaged (mother–father) response accounted for the vast majority of data (69%), followed by mother-reported data (25%), missing data (5%), and father-reported data (1%). Combining parent data was appropriate, given several considerations (Holmbeck, Li, Schurman, Friedman, & Coakley, 2002): First, differences between mean levels of mother and father ratings within each wave across the various outcomes were relatively small in magnitude; Cohen's *d* for these differences ranged from 0.15 to 0.33 ($M = .24$, $SD = 0.06$). Second, the between-parent correlations were quite high; intraclass correlations over assessment waves and outcomes ranged from .53 to .72 ($M = .63$, $SD = .08$). Third, in growth models that were estimated separately for mother- and father-report models (data not presented), the functional form of growth over time (i.e., linear vs. quadratic) was consistent across all analyses, except for one (i.e., attention problems; growth was quadratic for mother report and linear for father report).

Intercorrelations Among the Outcome Measures

In the analyses that follow, we examine growth over time in 14 outcome measures that assess various aspects of psychosocial adjustment in adolescents with SB. To assess the degree of intercorrelation among these various outcomes, we examined the magnitude of correlations within the SB and comparison groups over the various assessment waves. The average correlation was small in magnitude (.17), and the vast majority of correlations (87%) did not exceed .40.

Preliminary Growth Modeling Considerations

Given our interest in modeling developmental trajectories, individual growth curve models were estimated using the Mixed Procedure in SAS statistical software (see Singer, 1998). Our analytical approach was modeled closely after that described and illustrated by DeLucia and Pitts (2006). In short, we first estimated unconditional growth models to determine the functional form of growth (e.g., linear vs. quadratic). Relative model fit was assessed by comparing the –2 log likelihood statistics of competing, nested models (Snijders & Bosker, 1999). Full maximum likelihood estimation was used for all models. Once the best fitting growth model was selected, five variables were entered as predictors of the growth parameters (e.g., trajectory intercepts, slopes): (a) illness status, (b) child gender, (c) SES, (d) standard score on the PPVT-R, and (e) the two-way interaction between illness status and child's gender. SES and PPVT-R scores were covariates. Nonsignificant interactions were trimmed from final models; all other effects were retained, regardless of significance.

Chronological age, centered at age 9, was the original "time" predictor in all models. In linear models, the fixed intercept estimate is interpreted as the average predicted score on the outcome for 9-year-old children. The fixed slope estimate is interpreted as the predicted constant rate of change in the outcome for a 1-year increase in age. For quadratic models, the fixed intercept has the same interpretation. The linear trend, however, is interpreted as the average predicted instantaneous growth rate for 9-year-old children. The quadratic component is the average rate of trajectory curvature. Random effects were estimated to capture individual-level variability in the various growth trajectory estimates. For example, estimating a random intercept allows individuals to have different intercepts. For each analysis, we indicate the highest-level growth form modeled (e.g., linear). Unless otherwise stated, both fixed and random effects were estimated for all relevant trajectory parameters (e.g., a linear model included fixed and random effects for intercepts and linear trends).

Results are presented in several ways. First, the estimates for significant illness status effects and interactions between illness status and gender are presented in the text. The group-specific

growth curve estimates are presented in Table 2; as such, these values are not explicitly referenced in the text. When relevant, these estimates were used to display graphically the results in Figures 2 through 7 (following methods illustrated by Aiken & West, 1991). The figures for nontransformed data were scaled according to minimum and maximum possible values on the original response scales (which ranged from 1 to 4 for all nontransformed variables, except for "observations of youth engagement in family interactions," which ranged from 1 to 5, but was graphed on the same 1 to 4 scale). The graph for one transformed variable (i.e., child-reported depressive symptoms) was scaled according to observed minimum and maximum values of the transformed variable. The model-implied means and standard errors on the outcomes for all analyses are presented in Table 3. Finally, the magnitude of illness status effects is reported as the proportional reduction in individual-level variance of relevant random intercept models, following methods outlined by Snijders and Bosker (1999, Chapter 7).

Perceived Competence

Scholastic competence. Separate analyses were conducted for child and parent reports of scholastic competence. Both growth models were linear. For parent report, there was a significant illness status effect in predicting intercepts, favoring the comparison group (estimate = .440, SE = .117, $p < .001$). Given the absence of illness status effects on linear trends, this significant group difference in competence was maintained over the age range. The illness status effects accounted for approximately 10% of incremental individual-level variance. For child report, there was a significant illness status effect in predicting intercepts (estimate = –.419, SE = .118, p = .001) and a nonsignificant illness status effect in predicting linear trends (estimate = .052, SE = .027, p = .058; see Figure 2). Trajectories converged over time. Significant competence differences at age 9 favoring the comparison group were eradicated by age 15 because growth in the SB group remained stable, whereas growth in the comparison group significantly declined over time (see Table 2). The illness status effects accounted for approximately 5% of incremental individual-level variance.

Social acceptance. Analyses were conducted for both parent and child reports of social acceptance. For parent report, growth was quadratic (although the quadratic component was estimated as a fixed effect only). There was a significant illness status effect in predicting differences in the average quadratic component (estimate = .017, SE = .009, p = .045). Trajectory curvature was more pronounced in the SB group relative to the comparison group (see Figure 3). There was also a significant illness status by child gender interaction in predicting linear growth rates at age 9 (estimate = .108, SE = .041, p = .008). For girls, the average linear trends at age 9 were significantly different because the SB group exhibited a more dramatic decline (see Table 2). In contrast, for boys, the average linear trends at age 9 were not significantly different. The most salient feature of Figure 3 is the convergence of trajectories for boys and the divergence of trajectories for girls. As such, initial illness status differences in social acceptance were accentuated for girls and attenuated for boys. The illness status effects accounted for approximately 10% of incremental individual-level variance.

Growth in child self-report of social acceptance was linear. There was a significant illness status effect on trajectory intercepts (estimate = –.27, SE = .12, p = .03), indicating higher levels of social acceptance among comparison children at age 9. Given the absence of significant linear trends (see Table 2), differences between the groups were maintained over time. The illness status effects accounted for approximately 5% of incremental individual-level variance.

CBCL number of friends. Growth over time in mother report of number of child's friends was quadratic (although the quadratic component was estimated as a fixed effect only). Illness status was a significant predictor of intercepts (estimate = –.369, SE = .146, p = .013), indicating that, on average, comparison children had more friends than did SB children at age 9 (see Figure 4). Although the linear and quadratic trends for both groups were significant (see Table 2), these trends were not significantly different from one another. As such, the growth curves displayed in Figure 4 are approximately parallel over the age range. The illness status effects accounted for approximately 9% of incremental individual-level variance.

Harter physical appearance. Child self-report of physical appearance was linear. There was a significant illness status by gender interaction in predicting linear slopes (estimate = .124, SE = .059, p = .036, see Figure 5). The separate plots for girls and boys are opposites in that for girls the trajectories share a similar starting point and diverge over time. For boys, however, trajectory starting points are disparate while the trajectories converge over time. Of the four simple slopes displayed in Figure 5, only the slope for girls with SB is statistically significant—indicating significant declines in self-reports of physical appearance over time (see Table 2). The illness status effects accounted for approximately 9% of incremental individual-level variance.

Symptomatology

CBCL Anxious/Depressed. An inverse transformation was used to reduce nonnormality of data for parent report on the CBCL Anxious/Depressed subscale. Growth was quadratic. Illness status was not a significant predictor of any of the growth curve estimates. The average trajectory had a significant negative quadratic component and decreased over time (see Table 2).

Child depression symptoms. An inverse transformation was applied to reduce nonnormality. Growth was linear. Illness status was a significant predictor of linear trends (estimate = –.013, SE = .005, p = .01; see Figure 6). For comparison children, the average linear trend was positive and significant, whereas for children with SB, the average linear trend was negative and nonsignificant (see Table 2). Although group differences on level of depression symptoms were not significantly different over the age range, the growth curves diverged by crossing over one another.[1]

Externalizing symptoms. Parent report of child externalizing symptoms was transformed by taking the natural logarithm of the

[1] We encountered a problem in attempting to quantify the R^2 associated with the relevant illness status effects in this analysis, because deletion of the illness status predictors from the full model resulted in a further reduction in individual-level variance, producing a negative R^2 estimate. Although negative R^2 values are not possible in traditional fixed effects regression models, they sometimes occur in the context of random effects models and are often an indication of model misspecification. For a more detailed discussion, see Snijders and Bosker (1999), Chapter 7.

Table 2
Growth Curve Estimates as a Function of Illness Status

Psychosocial outcome	Comparison/combined			Spina bifida		
	Est	*SE*	*p*	Est	*SE*	*p*
Scholastic competence (parent report)						
Intercept	3.282	.078	<.001	2.842	.078	<.001
Linear	−0.017	.012	.197	−0.025	.013	.059
Scholastic competence (youth report)						
Intercept	3.180	.080	<.001	2.761	.080	<.001
Linear	−0.039	.018	.029	0.012	.018	.502
Social acceptance (parent report)						
Intercept						
Girls	3.384	.096	<.001	3.117	.101	<.001
Boys	3.371	.096	<.001	3.096	.088	<.001
Linear						
Girls	−0.022	.045	.626	−0.187	.049	<.001
Boys	−0.079	.046	.085	−0.137	.041	<.001
Quadratic						
Girls	−0.001	.007	.935	0.017	.008	.029
Boys	0.004	.007	.601	0.021	.007	.001
Social acceptance (youth report)						
Intercept	3.104	.083	<.001	2.838	.082	<.001
Linear	−0.003	.020	.861	0.002	.020	.920
Number of friends (mother report)						
Intercept	2.484	.098	<.001	2.115	.097	<.001
Linear	0.442	.051	<.001	0.332	.052	<.001
Quadratic	−0.055	.008	<.001	−0.038	.009	<.001
Physical appearance (youth report)						
Intercept						
Girls	3.019	.118	<.001	2.966	.125	<.001
Boys	3.256	.118	<.001	2.862	.113	<.001
Linear						
Girls	−0.050	.029	.090	−0.113	.033	.001
Boys	−0.044	.030	.135	0.017	.029	.572
Anxious/depressed (parent report)						
Intercept	0.303	.016	<.001			
Linear	0.005	.008	.540			
Quadratic	−0.002	.001	.036			
Child depression inventory (youth report)						
Intercept	0.172	.014	<.001	0.208	.014	<.001
Linear	0.007	.003	.033	−0.006	.003	.084
Externalizing (CBCL, parent report)						
Intercept	0.200	.010	<.001			
Linear	−0.006	.002	<.001			
Externalizing (Harter, youth report)						
Intercept	3.051	.046	<.001			
Linear	0.003	.011	.807			
Attention problems (parent report)						
Intercept	0.187	.017	<.001	0.263	.017	<.001
Linear	−0.005	.003	.069	−0.005	.003	.069
Youth engagement in family interaction (observational)						
Intercept	3.731	.050	<.001	3.396	.050	<.001
Linear	0.008	.023	.727	0.125	.024	<.001
Quadratic	−0.003	.004	.436	−0.016	.004	<.001
Youth positive affect (observational)						
Intercept	3.443	.027	<.001			
Linear	0.017	.014	.227			
Quadratic	−0.008	.002	.001			
Youth power/control (observational)						
Intercept	2.642	.044	<.001	2.420	.044	<.001
Linear	0.024	.008	.005	0.036	.009	<.001

Note. In the absence of significant illness status effects, the average trajectory estimates across groups ("combined") were generated by centering all individual-level predictors to have a grand mean equal to zero. Est = estimated; CBCL = Child Behavior Checklist (Achenbach, 1991).

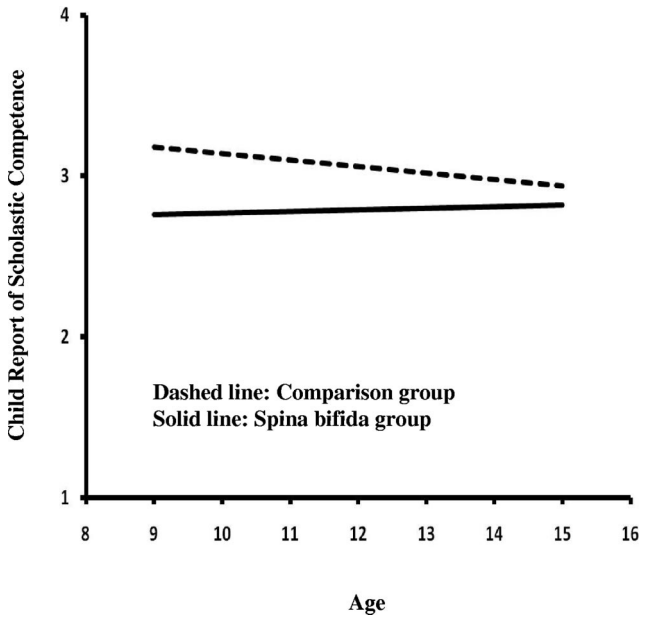

Figure 2. Illness status effect in predicting growth rates of child report on the Harter Scholastic Competence subscale (Harter, 1985).

original scale to reduce nonnormality. Growth over time was linear. Although illness status did not significantly predict intercepts or linear trends, the average linear rate of change was negative and statistically significant, indicating significant declines over time (see Table 2).

Child self-report of externalizing symptoms was assessed with items from the Harter Behavioral Conduct subscale. Growth was quadratic. Some estimation problems were encountered when the predictors were added to the model. As such, the possible effects of predictors in both a simplified quadratic model (with predictors of intercepts only) and a more complex linear model (with predictors of intercepts and linear trends) were explored. There were no significant illness status effects in either model, and the average trajectory was quite flat (see Table 2 for estimates based on the linear model).

CBCL attention problems. An inverse transformation was applied to reduce nonnormality. For parent report of attention problems, growth over time was linear. There was a significant illness status effect on trajectory intercepts (estimate = –.076, SE = .025, p = .003), indicating that parents of SB children reported more child attention problems than did comparison parents. This effect, coupled with the absence of illness status effects in predicting linear trends, produced a significant separation between the two trajectories that was maintained over time (see Table 2). The illness status effects accounted for approximately 7% of incremental individual-level variance.

Observational Measures of Adolescent Behavior During Family Interaction

Observed level of child engagement in family interaction. Growth over time in observed child engagement was quadratic (although the quadratic component was estimated as a fixed effect only). Illness status was a significant predictor of all trajectory components (estimate = –.335, SE = .075, $p < .001$, for intercepts; estimate = .117, SE = .036, p = .001, for the linear effect; and estimate = –.013, SE = .006, p = .022, for the quadratic component; see Table 2 for estimates by group). As depicted in Figure 7, these illness status effects led to a convergence of the two trajectories. Although comparison children were significantly more engaged in the family interaction tasks at age 9, this difference was attenuated and nonsignificant by age 15. Inclusion of the illness status predictors accounted for approximately 4% of incremental individual-level variance.

Observational child positive affect. Growth over time in observed positive affect was quadratic in nature (although the quadratic component was estimated as a fixed effect only). Illness status was not a significant predictor of the trajectory parameters. The average curve was characterized by a nonsignificant linear component at age 9 and a negative and significant quadratic component, creating an average curve that was initially relatively flat and then began to bend slightly downward (see Table 2).

Observational child power/control. Growth over time in observed child power/control was linear (although the linear component was estimated as a fixed effect only). There was a significant illness status effect in predicting trajectory intercepts (estimate = –.222, SE = .065, p = .001), indicating higher levels of observed power/control among comparison children. Given that illness status was not a significant predictor of linear rates of change, these differences were maintained over the age range, with a slight increase in both groups (see Table 2). The illness status effects accounted for approximately 7% of incremental individual-level variance.

Discussion

The purpose of this study was to examine growth in several domains of psychosocial adjustment in children with SB and in a matched comparison sample. This study was a longitudinal follow-up to an earlier cross-sectional investigation that found a number of significant differences between the two samples prior to adolescence (Holmbeck et al., 2003). In this study, several types of developmental pathways emerged that varied across groups and psychosocial outcomes. For several outcomes, group differences were maintained over time (from ages 8 to 15), indicating that adolescents with SB have enduring difficulties with academic performance, attention, and social development. For other outcomes, these group differences were attenuated over time. Such convergence across groups suggests that in some areas, children with SB demonstrate resilience that develops over time (Masten et al., 2004). Finally, relative to the girls from the comparison sample, girls with SB were found to be at risk for an exacerbation of social difficulties over time. In discussing the findings of this study, we refer back to the developmentally oriented models presented in Figure 1.

Maintenance of Psychosocial Difficulties and Group Differences Over Time (Figure 1A)

When the children in this study were 8 or 9 years old, those with SB were found to have difficulties across several domains of psychosocial adjustment. For some of these measures of adjust-

Table 3
Model-Implied Means and Standard Errors on the Outcomes as a Function of Age

Psychosocial outcome	Age 9		Age 11		Age 13		Age 15	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Scholastic competence (parent report)								
Comparison	3.282	.078	3.249	.071	3.216	.072	3.183	.083
Spina bifida	2.842	.078	2.792	.071	2.743	.074	2.693	.085
Scholastic competence (youth report)								
Comparison	3.180	.080	3.102	.067	3.024	.071	2.945	.091
Spina bifida	2.761	.080	2.786	.067	2.811	.074	2.835	.095
Social acceptance (parent report)								
Comparison girls	3.384	.096	3.338	.094	3.288	.108	3.234	.133
Comparison boys	3.371	.096	3.227	.093	3.111	.107	3.023	.131
Spina bifida girls	3.117	.101	2.809	.101	2.637	.115	2.599	.146
Spina bifida boys	3.096	.088	2.907	.090	2.885	.102	3.030	.130
Social acceptance (youth report)								
Comparison	3.104	.083	3.097	.065	3.090	.068	3.084	.091
Spina bifida	2.838	.082	2.842	.065	2.846	.070	2.850	.095
Number of friends (mother report)								
Comparison	2.484	.098	3.150	.089	3.380	.094	3.173	.110
Spina bifida	2.115	.097	2.626	.092	2.832	.095	2.733	.118
Physical appearance (youth report)								
Comparison girls	3.019	.118	2.919	.090	2.819	.095	2.719	.030
Comparison boys	3.256	.118	3.167	.089	3.078	.094	2.989	.130
Spina bifida girls	2.966	.125	2.741	.095	2.516	.104	2.291	.145
Spina bifida boys	2.862	.113	2.895	.085	2.928	.093	2.961	.129
Anxious/depressed (parent report)								
Combined sample[a]	0.303	.016	0.302	.015	0.282	.016	0.243	.017
Child depression inventory (youth report)								
Comparison	0.172	.014	0.186	.011	0.200	.013	0.214	.017
Spina bifida	0.208	.014	0.196	.011	0.184	.013	0.172	.017
Externalizing (CBCL, parent report)								
Combined sample[a]	0.200	.010	0.188	.010	0.175	.010	0.162	.011
Externalizing (Harter, youth report)								
Combined sample[a]	3.051	.046	3.056	.040	3.062	.044	3.067	.058
Attention problems (parent report)								
Comparison	0.187	.017	0.177	.015	0.166	.015	0.156	.017
Spina bifida	0.263	.017	0.253	.015	0.242	.015	0.231	.017
Youth engagement in family interaction (observational)								
Comparison	3.731	.050	3.736	.045	3.719	.043	3.679	.046
Spina bifida	3.396	.050	3.581	.047	3.638	.045	3.565	.053
Youth positive affect (observational)								
Combined sample[a]	3.443	.027	3.446	.025	3.384	.027	3.259	.034
Youth power/control (observational)								
Comparison	2.642	.044	2.690	.037	2.738	.038	2.786	.045
Spina bifida	2.420	.044	2.492	.038	2.564	.040	2.637	.050

Note. CBCL = Child Behavior Checklist (Achenbach, 1991).
[a] In the absence of significant illness status effects, means and standard errors for the combined sample were generated by centering all individual-level predictors to have a grand mean equal to zero.

ment, children with SB continued to exhibit such difficulties from preadolescence (ages 8–9) to middle adolescence (ages 14–15), matching the predictions presented in Figure 1A. Specifically, those with SB continued to lag behind in the following areas: number of friends, child-reported social acceptance, attention problems, and the amount of influence or control in family discussions. For some measures, the trajectories tended to be flat and parallel, as in the figure on the left in Figure 1A. Specifically, trajectories for attention problems conformed to this figure, as did findings for child-reported social acceptance. But in other cases, differences were maintained despite longitudinal change in both samples. For example, children in the comparison group maintained a relative advantage in terms of number of friends over the age range. Using Cohen's *d* as an indicator of magnitude, these differences fluctuated from a low of 0.32 at age 9 to a high of 0.50 at age 13. Finally, the amount of child control exhibited in family relations increased significantly, but only slightly, in both groups during the period of the study, with the comparison group maintaining a higher level of influence throughout (again, approximating the middle figure in Figure 1A).

Findings such as those in Figure 1A suggest that children with SB move along developmental trajectories similar to typically developing children during the transition to adolescence, but they also continue to lag behind in several important areas of psychosocial functioning throughout this age period. As is typical during the adolescent developmental period, children with SB experience

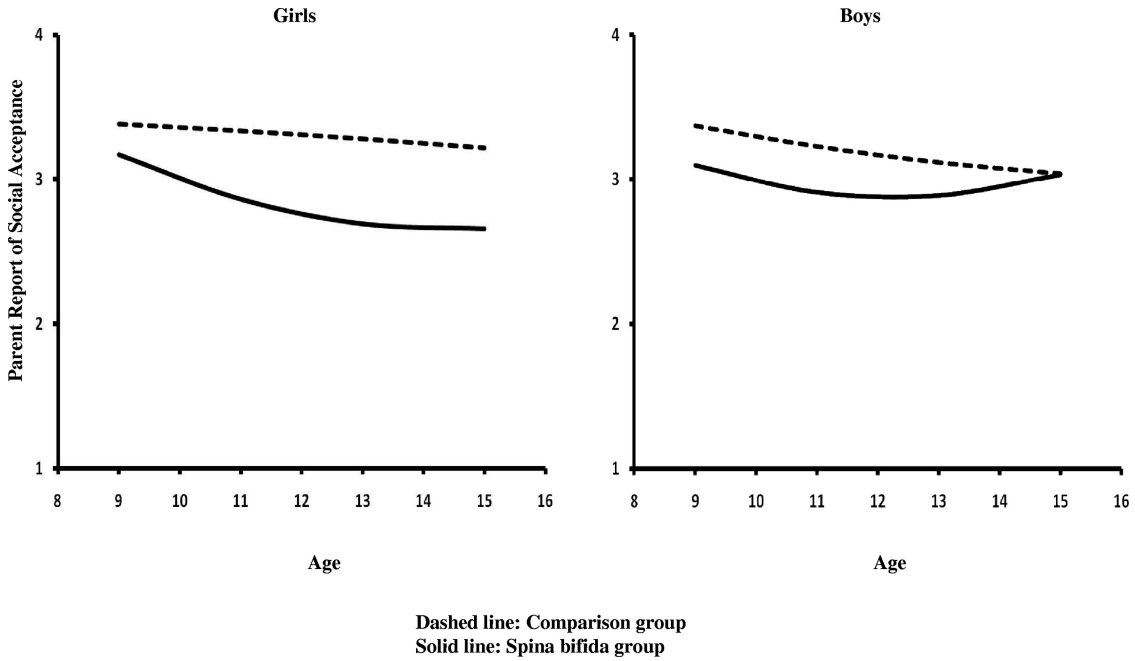

Figure 3. Illness status by gender interaction in predicting growth rates of parent report on the Harter Social Acceptance subscale (Harter, 1985).

an increase in their friendship circle (Brown, 1990; Steinberg, 2005), but they have fewer friends in late childhood compared with children without SB, and they continue to have fewer friends during the transition to adolescence. Similarly, adolescents with SB gain more influence in their interactions with their family (Steinberg, 2005), but they never achieve as much influence as their comparison counterparts. Other issues that were problematic for children with SB (Holmbeck et al., 2003) continue to be problematic during adolescence, particularly in areas that relate to academic functioning (e.g., attention problems; Burmeister, Hannay, Fletcher, Boudousquie, & Dennis, 2005; Fletcher, Dennis, & Northrup, 2000; Rose & Holmbeck, 2007).

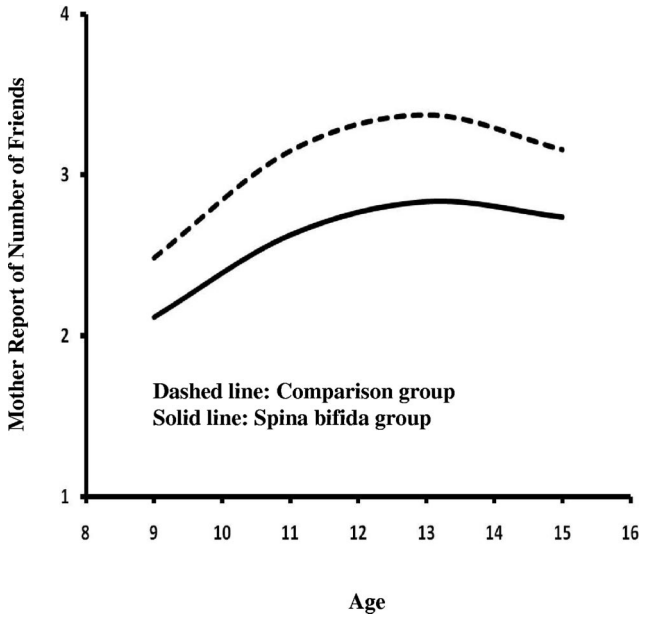

Figure 4. Illness status effect in predicting intercepts of mother report on the Child Behavior Checklist "number of friends" item (Achenbach, 1991).

Divergence With Increasing Group Differences (Figure 1B)

Evidence for developmental divergence was found, but only for girls within the SB group. Specifically, parents' perceptions of their daughters' level of social acceptance decreased more dramatically early on for girls with SB. As such, the relative group difference at age 9 was smaller ($d = 0.23$) than at age 13 ($d = 0.50$). Similar results were found for child-reported perceptions of physical appearance, although the divergence of female trajectories was more striking. For example, at age 9 the relative group difference was trivial ($d = 0.04$); at age 15, however, the relative group difference was moderate ($d = 0.42$). Such findings for these girls are consistent with those predicted earlier regarding Hill and Lynch's (1983) gender-intensification hypothesis. Hill and Lynch proposed that there is an intensification of gender-related role expectations during adolescence, with the expectation that typically developing girls will view their physical appearance and the quality of their friendships (i.e., the level of intimacy in such friendships) as increasingly salient during the adolescent transition. The fact that girls with SB are likely to have difficulties in the social and appearance domains may make such increased salience more difficult for these girls than it would be for typically developing girls. Simply put, during the adolescent transition, increased attention is placed on areas of development that are particularly challenging for girls with SB.

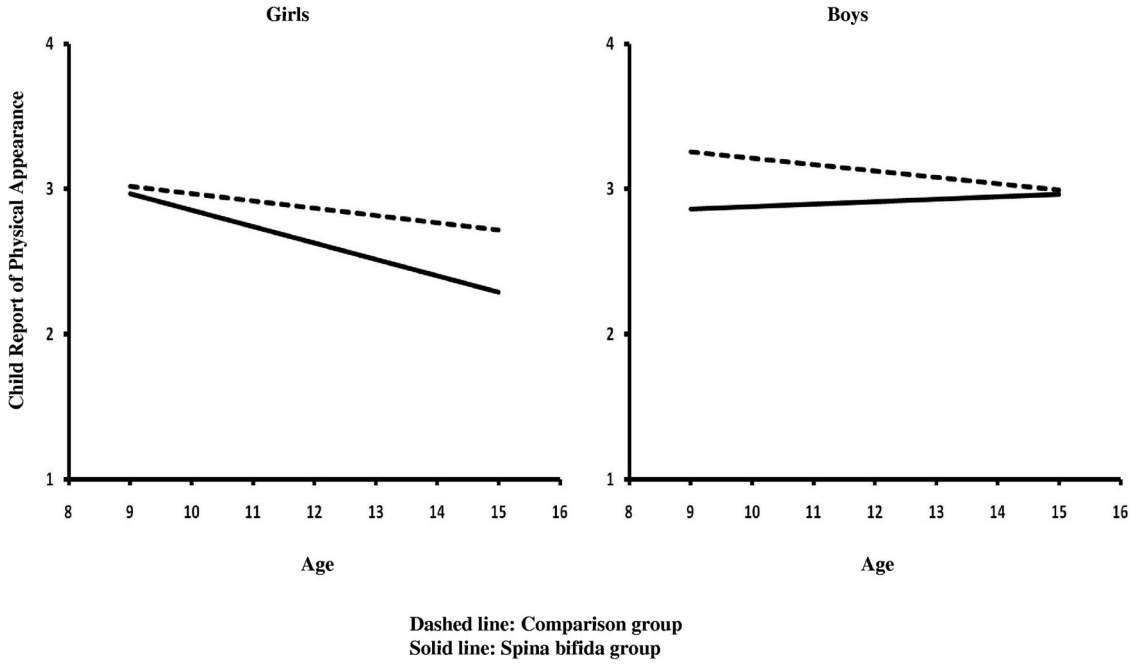

Figure 5. Illness status by gender interaction in predicting growth rates of child report of physical appearance.

Convergence With Decreasing Group Differences (Figure 1C)

For some outcomes, the developmental trajectories of children with SB were found to converge with those of the comparison sample, indicating that differences between groups observed at ages 8–9 were reduced significantly by ages 14–15. Such convergence highlights potential protective processes (Cicchetti & Rogosch, 2002). Specifically, children with SB exhibited convergence for child-reported scholastic competence and for the level of child engagement in the family. Specifically, group differences in scholastic competence and engagement that were present at age 9 were nonsignificant by age 15. Such findings suggest that children with SB can catch up with their typically developing counterparts, thus supporting a resilience interpretation of the findings (Masten et al., 2004). On the other hand, if these findings for engagement are

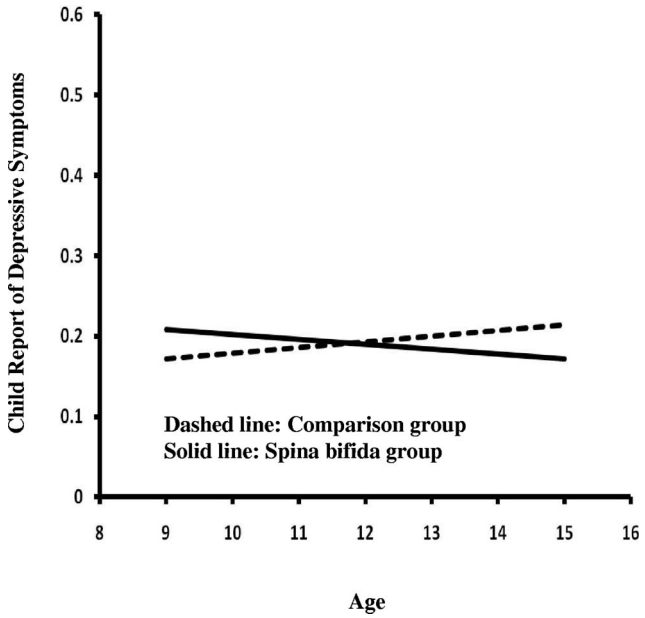

Figure 6. Illness status effect in predicting linear slopes of child report of depressive symptoms.

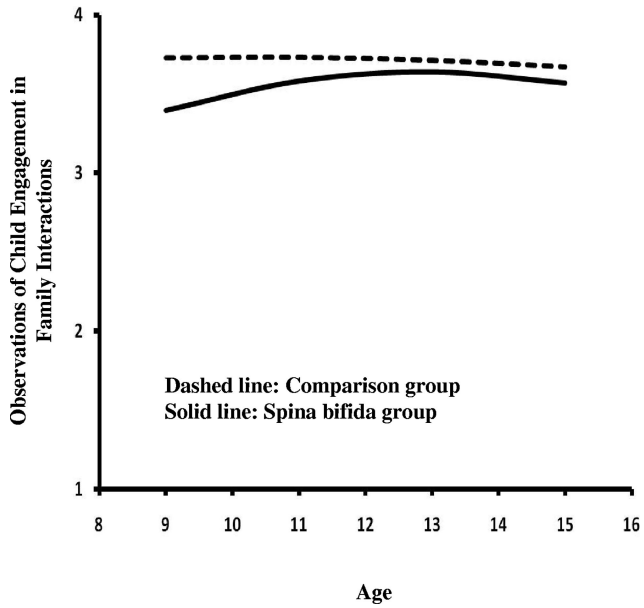

Figure 7. Illness status effect in predicting growth rates of observations of child engagement in family interactions.

interpreted in combination with the findings for child control during family interaction, it appears that the increased engagement with age is not necessarily accompanied by higher levels of actual influence within the family.

Divergence With No Change in SB Trajectory: The Case of Depressive Symptoms (Figure 1D)

It is well known that depressive symptoms are likely to increase during the transition to adolescence, particularly for girls (Rutter, Izard, & Read, 1986). The findings in this study for child report on the CDI are consistent with past work insofar as rates of symptoms were found to increase for those from the comparison sample. Interestingly, there was no such increase in the SB group. As we have speculated before (Coakley et al., 2002), it may be that parents and children in families of children with SB may be less responsive to the developmental changes of adolescence than are families of typically developing children. It may be that children with SB never show the increases that are typical of the period, or it may be that the increase in internalizing symptoms occurs later (Coakley et al., 2002). We would need to follow the participants into young adulthood to test such hypotheses.

Similarities and Differences in Findings Across Methods and Informants

In most cases, the conclusions advanced here were robust across methods (i.e., questionnaire, observational) and respondents (i.e., parents, children). As noted prior to collapsing data across mother and father data, the functional form of growth over time was similar across parents for all analyses except one. Also, analyses that demonstrated stability in group differences over time were found for all methods and reporters. Finally, a lack of illness status effects was often consistent across reporters (e.g., for externalizing symptoms). On the other hand, exceptions to such consistency were found. For example, illness status by gender interactions were found for parent report of social acceptance and child report of perceived physical appearance. Findings for child report of social acceptance did not differ by gender. Although gender was a significant moderator of associations between illness status and psychosocial outcomes for different reporters, there was a lack of consistency that was noteworthy. It is possible that social comparisons and perceptions of social acceptance require more cognitive sophistication than perceptions of physical appearance. In other words, child reports of social acceptance may have been hampered by "noise" that was not present in the parent report data for the same outcome, thus making it difficult to detect the moderating effects of gender in these analyses versus those for perceived physical appearance.

Limitations and Directions for Future Research

Several limitations of the present study have implications for the design of future research. First, the small sample size of this study may have limited our ability to detect group differences. Second, the group-level matching strategy employed in this study may have provided a less precise matching solution than would have been provided by an individual-level matching approach. Moreover, the representativeness of the comparison sample is called into question because the sample of 72 assessed families was recruited from over 1,700 potential participants. Third, our sample included very few Latino families; the high prevalence rates of SB in this population necessitate a rigorous focus on this ethnic group in future studies of such children. Fourth, results based on the observational tasks may not generalize to actual family interactions. Fifth, the analyses in this study focused on children and adolescents from ages 8 to 15. The developmental trajectories that we observed during this period may change dramatically in later adolescence or early adulthood as adolescents with SB navigate these important developmental transitions. Moreover, it will be important to study children with SB prior to the age of 8 to determine the starting point of the observed developmental trajectories (e.g., Lomax-Bream, Barnes, Copeland, Taylor, & Landry, 2007). Sixth, the measure of receptive vocabulary used in this study was, admittedly, a weak proxy for verbal IQ. Finally, the illness status effects accounted for between 4% and 15% of individual-level variance. Thus, although there is considerable consistency in the findings presented in this study, there is also a considerable amount of variance left unexplained after accounting for group differences.

Clinical Implications

The present findings also have several clinical implications. At the most general level, it is clear that children with SB exhibit a variety of psychosocial difficulties that begin prior to the adolescent period and continue into adolescence. Moreover, these difficulties are apparent to parents, to external observers, and to the adolescents themselves. Specifically, children with SB have enduring difficulties with attention problems and social development. These problems are not transitory but chronic in nature. Thus, prevention efforts that target such difficulties in this population should begin in childhood (prior to adolescence), should be maintained during the course of development, and should target challenges that arise anew during each new developmental period. Given that such children exhibit social passivity at young ages in the context of the family and have peer difficulties during the entire adolescent period, interventionists should consider involving both parents and peers in these prevention efforts. In addition, girls appear to be at risk for escalating social and physical appearance difficulties as they navigate the adolescent period. Given that we have found similar effects for autonomy development in boys with SB (Friedman et al., 2009), some components of interventions may need to be gender specific. Although the adolescent period presents a host of new psychosocial challenges for any child, the results of this study highlight areas that are particularly challenging for adolescents with SB that can be targeted by clinicians who work with these children.

References

Achenbach, T. M. (1991). *Manual for the Child Behavior Checklist/4–18 and 1991 Profile*. Burlington: University of Vermont, Department of Psychiatry.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Thousand Oaks, CA: Sage.

Barkley, R. A. (2006). Attention-deficit/hyperactivity disorder. In D. A. Wolfe & E. J. Mash (Eds.), *Behavioral and emotional disorders in*

adolescents: Nature, assessment, and treatment (pp. 91–152). New York, NY: Guilford Press.

Brown, B. B. (1990). Peer groups and peer cultures. In S. S. Feldman & G. R. Elliott (Eds.), *At the threshold: The developing adolescent* (pp. 171–196). Cambridge, MA: Harvard University Press.

Burmeister, R., Hannay, H. J., Fletcher, J. M., Boudousquie, A., & Dennis, M. (2005). Attention problems and executive functions in children with spina bifida meningomyelocele. *Child Neuropsychology, 11,* 265-284.

Centers for Disease Control. (2008). QuickStats: Spina bifida and anencephaly rates: United States, 1991, 1995, 2000, and 2005. *Morbidity and Mortality Weekly Report, 57,* 15.

Cicchetti, D., & Rogosch, F. A. (2002). A developmental psychopathology perspective on adolescence. *Journal of Consulting and Clinical Psychology, 70,* 6–20.

Coakley, R. M., Holmbeck, G. N., Friedman, D., Greenley, R. N., & Thill, A. W. (2002). A longitudinal study of pubertal timing, parent–child conflict, and cohesion in families of young adolescents with spina bifida. *Journal of Pediatric Psychology, 27,* 461–473.

Cox, M. J., & Brooks-Gunn, J. (1999). *Conflict and cohesion in families: Causes and consequences.* Mahwah, NJ: Erlbaum.

DeLucia, C., & Pitts, S. C. (2006). Applications of individual growth curve modeling for pediatric psychology research. *Journal of Pediatric Psychology, 31,* 1002–1023.

Dunn, L. M., & Dunn, L. M. (1981). *Peabody Picture Vocabulary Test–Revised (PPVT*). Circle Pines, MN: American Guidance Service.

Feldman, S. S., & Elliott, G. R. (Eds.). (1990). *At the threshold: The developing adolescent.* Cambridge, MA: Harvard University Press.

Ferreira, A. J. (1963). Decision making in normal and pathological families. *Archives of General Psychiatry, 8,* 68–73.

Fletcher, J. M., Dennis, M., & Northrup, H. (2000). Hydrocephalus. In K. O. Yeates, M. D. Ris, & H. G. Taylor (Eds.), *Pediatric neuropsychology: Research, theory, and practice* (pp. 25–46). New York, NY: Guilford Press.

Friedman, D., Holmbeck, G. N., DeLucia, C., Jandasek, B., & Zebracki, K. (2009). Trajectories of autonomy development across the adolescent transition in children with spina bifida. *Rehabilitation Psychology, 54,* 16–27.

Galambos, N. L., Almeida, D. M., & Petersen, A. C. (1990). Masculinity, femininity, and sex role attitudes in early adolescence: Exploring gender intensification. *Child Development, 61,* 1905–1914.

Garber, J., Keiley, M. K., & Martin, N. C. (2002). Developmental trajectories of adolescents' depressive symptoms: Predictors of change. *Journal of Consulting and Clinical Psychology, 70,* 79–95.

Gilligan, C., Lyons, N. P., & Hanmer, T. J. (Eds.). (1990). *Making connections: The relational worlds of adolescent girls at Emma Willard School.* Cambridge, MA: Harvard University Press.

Harter, S. (1985). *Manual for self-perception profile for children: Revision of the Perceived Competence Scale for Children.* Denver, CO: University of Denver.

Hill, J. P., & Lynch, M. E. (1983). The intensification of gender-related role expectations during early adolescence. In J. Brooks-Gunn, & A. C. Petersen (Eds.), *Girls at puberty: Biological and psychosocial perspectives* (pp. 201–228). New York, NY: Plenum Press.

Hollingshead, A. A. (1975). *Four-factor index of social status.* Unpublished manuscript, Yale University, New Haven, CT.

Holmbeck, G. N. (1997). Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators: Examples from the child-clinical and pediatric psychology literatures. *Journal of Consulting and Clinical Psychology, 65,* 599–610.

Holmbeck, G. N. (2002). A developmental perspective on adolescent health and illness: An introduction to the special issues. *Journal of Pediatric Psychology, 27,* 409–416.

Holmbeck, G. N., Belvedere, M., Gorey-Ferguson, L., & Schneider, J. (1995). *Manual for family macro-coding.* Unpublished manuscript, Loyola University of Chicago, Chicago, IL.

Holmbeck, G. N., Friedman, D., Abad, M., & Jandasek, B. (2006). Development and psychopathology in adolescence. In D. A. Wolfe & E. J. Mash (Eds.), *Behavioral and emotional disorders in adolescents: Nature, assessment, and treatment* (pp. 21–55). New York, NY: Guilford Press.

Holmbeck, G. N., Li, S., Schurman, J. V., Friedman, D., & Coakley, R. M. (2002). Collecting and managing multi-source and multi-method data in studies of pediatric populations. *Journal of Pediatric Psychology, 27,* 5–18.

Holmbeck, G. N., Westhoven, V. C., Shapera Phillips, Bowers, R., Gruse, C., Nikolopoulos, T., . . . Davison, K. (2003). A multimethod, multiinformant, and multidimensional perspective on psychosocial adjustment in preadolescents with SB. *Journal of Consulting and Clinical Psychology, 71,* 782–796.

Kerig, P. K., & Lindahl, K. M. (2001). *Family observational coding systems: Resources for systemic research.* Mahwah, NJ: Erlbaum.

Kovacs, M. (1992). *Children's Depression Inventory–Manual.* North Tonawanda, NY: Multi-Health Systems.

Larson, R. W., Richards, M. H., Moneta, G., Holmbeck, G. N., & Duckett, E. (1996). Changes in adolescents' daily interactions with their families from ages 10 to 18: Disengagement and transformation. *Developmental Psychology, 32,* 744–754.

Lavigne, J. V., & Faier-Routman, J. (1992). Psychological adjustment to pediatric physical disorders: A meta-analytic review. *Journal of Pediatric Psychology, 17,* 133–157.

Lomax-Bream, Barnes, M., Copeland, K., Taylor, H. B., & Landry, S. H. (2007). The impact of spina bifida on development across the first 3 years. *Developmental Neuropsychology, 31,* 1–20.

Masten, A. S., Burt, K. B., Roisman, G. I., Obradovic, J., Long, J. D., & Tellegen, A. (2004). Resources and resilience in the transition to adulthood: Continuity and change. *Development and Psychopathology, 16,* 1071–1094.

McMahon, R. J., & Kotler, J. S. (2006). Conduct problems. In D. A. Wolfe & E. J. Mash (Eds.), *Behavioral and emotional disorders in adolescents: Nature, assessment, and treatment* (pp. 153–225). New York, NY: Guilford Press.

Robin, A. L., & Foster, S. L. (1989). *Negotiating parent–adolescent conflict: A behavioral family systems approach.* New York, NY: Guilford Press.

Rose, B., & Holmbeck, G. N. (2007). Attention and executive functions in adolescents with spina bifida. *Journal of Pediatric Psychology, 32,* 983–994.

Rutter, M., Izard, C. E., & Read, P. B. (1986). *Depression in young people: Developmental and clinical perspectives.* New York, NY: Guilford Press.

Shields, N., Taylor, N. F. G., & Dodd, K. J. (2008). Self-concept in children with spina bifida compared to typically developing children. *Developmental Medicine & Child Neurology, 50,* 733–743.

Simmons, R. G., & Blyth, D. A. (1987). *Moving into adolescence: The impact of pubertal change and school context.* New York, NY: Aldine de Gruyter.

Singer, J. D. (1998). Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics, 24,* 323–355.

Smetana, J. G., Yau, J., Restrepo, A., & Braeges, J. L. (1991). Adolescent–parent conflict in married and divorced families. *Developmental Psychology, 27,* 1000–1010.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling.* London, England: Sage.

Stein, R., & Jessop, D. (1982). A noncategorical approach to childhood chronic illness. *Public Health Reports, 97,* 354–362.

Steinberg, L. (2005). *Adolescence* (7th ed.). Boston, MA: McGraw-Hill.

Suen, H. K., & Ary, D. (1989). *Analyzing quantitative behavioral observation data.* Hillsdale, NJ: Erlbaum.

Walsh, F. (1993). *Normal family processes* (2nd ed.). New York, NY: Guilford Press.

Williams, P. G., Holmbeck, G. N., & Neff Greenley, R. (2002). Adolescent health psychology. *Journal of Consulting and Clinical Psychology, 70,* 828–842.

Wills, K. E., Holmbeck, G. N., Dillon, K., & McLone, D. G. (1990). Intelligence and achievement in children with myelomeningocele. *Journal of Pediatric Psychology, 15,* 161–176.

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