

Adolescent Predictors of Emerging Adulthood Milestones in Youth with Spina Bifida*

Jill M. Zukerman, PhD, Katie A. Devine, PhD, and Grayson N. Holmbeck, PhD

Loyola University Chicago

Correspondence concerning this article should be addressed to Grayson N. Holmbeck, Department of Psychology, Loyola University Chicago, 1032 W. Sheridan Rd, Chicago, IL, 60660, USA.

E-mail: gholmbe@luc.edu

Present address: Jill M. Zukerman is now at the Department of Behavioral Sciences, Rush University Medical Center, Chicago, IL. Katie A. Devine is now at the Department of Radiation Oncology, University of Rochester Medical Center, Rochester, NY.

*This article is based on the dissertation work of the first author with significant contributions from the second author throughout the publication and revision process.

Received February 2, 2010; revisions received July 30, 2010; accepted July 31, 2010

Objective To examine the predictive utility of demographic (illness status and SES), individual (neurocognitive functioning and intrinsic motivation), and family-based (parental intrusiveness) factors during adolescence on the achievement of emerging adulthood milestones in youth with and without spina bifida (SB). **Methods** Questionnaire and observational data were collected from 14/15-year-old adolescents with SB, typically developing peers, mothers, and teachers. Emerging adulthood milestones (i.e., leaving home, attending college, employment, romantic relationship experience, and number of friendships) were assessed at ages 18/19 years in the full sample and subset of youth who graduated from high school. **Results** Typically, developing youth were more likely to achieve milestones compared to youth with SB in the full sample but not when only high school graduates were compared. Executive function, SES, intrinsic motivation, and parental intrusiveness emerged as significant predictors for particular milestones. **Conclusions** Interventions targeting executive function, intrinsic motivation, and parenting behavior may facilitate achievement of emerging adulthood milestones.

Key words adolescence; autonomy; emerging adulthood; milestones; spina bifida.

Introduction

Emerging adulthood is a distinct developmental period between 18 and 25 years of age characterized by dramatic changes and explorations, including changes in world views and career interests, and an intensification of romantic partnering (Arnett, 2000, 2006). There is considerable variability among emerging adults with respect to independent living, marital status, and educational status between the ages of 18 and 25 years. During this period, many (but

not all) emerging adults leave home; roughly 30% leave home for college, ~40% leave home for employment opportunities, and ~60% experience of period of cohabitation with a romantic partner (Arnett, 2000; Goldscheider & Goldscheider, 1994). Given that the majority of research on emerging adulthood focuses on typically developing, college-attending youth, little is known about the impact of a chronic condition, such as spina bifida (SB), on the milestones of emerging adulthood. Such work is important

because characteristics of the condition may pose barriers to achievement of various academic, vocational, and social milestones.

SB is a relatively common congenital birth defect (18 out of every 100,000 live births in 2005; Centers for Disease Control and Prevention [CDC], 2008) that is caused by a failed closure of one or more vertebrae during the early weeks of gestation. Complications include paralyzed lower extremities, urinary and bowel incontinence, and hydrocephalus. The medical regimen and self-care tasks required to maintain optimal health can be demanding, including catheterization, bowel programs, shunt monitoring, and skin checks (Charney, 1992). Emerging adults with SB must manage illness-related challenges such as self-care demands, impaired cognitive abilities, impaired social skills, and medical problems, in addition to pursuing normative developmental milestones.

Most young adults with SB do not live independently (77% of young adults with SB ages 19–25 years live at home vs. 59% for typically developing emerging adults ages 17–27 years; Bowman, McLone, Grant, Tomita, & Ito, 2001; Cohen, Kasen, Chen, Hartmark, & Gordon, 2003). Emerging adults with SB are less likely to go to college than typically developing emerging adults (49% of individuals with SB ages 19–25 years go to college vs. 66% of typically developing youth ages 17–27 years; Bowman et al., 2001; Cohen et al., 2003). Recent studies of vocational outcomes report rates of full- or part-time employment ranging from 34% to 41% (Bowman et al., 2001; McDonnell & McCann, 2000), which are significantly lower than the rates found in typically developing youth (e.g., roughly 75%; Cohen et al., 2003).

In terms of social development, emerging adults with SB are less likely to have ever been in a romantic relationship (e.g., 54% in 16-to 25-year-olds with SB, Verhoef et al., 2005 vs. 70% of typically developing 17-year-olds, Collins, Welsh, & Furman, 2009). Moreover, the rates for “a current romantic relationship” are low in youth with SB aged 16–25 years (e.g., 25%; Verhoef et al., 2005) compared to typically developing youth (e.g., 48% in typically developing 18-year-olds; Gerhardt, Vannatta, Valerius, Correll, & Noll, 2007). Given that aspects of peer relations have been associated with qualities of romantic relationships in adolescence (Collins & Van Dulmen, 2006; Furman, Simon, Shaffer, & Bouchey, 2002), and that adolescents with SB are at greater risk for social isolation (Appleton, Ellis, Minchom, Lawson, Boll, & Jones, 1997), it is important to consider an individual’s degree of engagement in peer relationships as well as the presence of romantic relationships.

While there are some data regarding the rates of achievement of emerging adulthood milestones for youth with SB, an important next step is to identify factors that predict successful achievement of these milestones. In this study, we used social–ecological theory (Bronfenbrenner, 1979; Kazak, Rourke, & Navsaria, 2009) as an organizing framework to examine adolescent predictors of emerging adulthood milestone achievement. Based on Bronfenbrenner’s (1979) work, the individual is at the center of the model and the various interacting contexts of influence are drawn around the individual from the most proximal (e.g., intra-individual and biological factors such as neurocognitive functioning and illness status) to more distal (e.g., interpersonal factors such as family functioning). There are three types of predictors that we considered: demographic (illness group status and socioeconomic status [SES]), individual (neurocognitive functioning and intrinsic motivation), and family-based (parental intrusiveness; see Figure 1). Although demographic factors can be conceptualized as more distal, we chose to include them as initial predictors in the model to evaluate the relative contributions of other individual and family factors beyond demographic predictors.

Socioeconomic status (SES) is an important demographic factor impacting rates of achievement of emerging adult milestones. For example, research has shown differences in the timing of full-time employment, postsecondary education, and financial independence among youth based on SES (Cohen et al., 2003; Goldscheider & Goldscheider, 1994). Low SES has also been linked with higher levels of family conflict and stress, and lower levels of family cohesion for children with SB (Holmbeck, Coakley, Hommeyer, Shapera, & Westhoven, 2002), which may impact a family’s ability to promote achievement of emerging adulthood milestones.

Past research has identified several individual or illness-related factors specific to SB that are associated with independence, vocational, and social outcomes. Specifically, youth with SB often have problems with attention, executive functioning, and visuomotor skills (Fletcher et al., 2004), which may affect academic performance (Bier, Morales, Liebling, Geddes, & Kim, 1997) and occupational outcomes (Hetherington, Dennis, Barnes, Drake, & Gentili, 2006). Compared to typically developing youth, adolescents with SB have demonstrated lower levels of intrinsic motivation, defined as an internal drive to perform an activity for its inherent interest and enjoyment (Holmbeck & Faier-Routman, 1995; Holmbeck et al., 2003; Ryan & Deci, 2000). Lower intrinsic motivation is likely to impact functioning in a variety of arenas, including

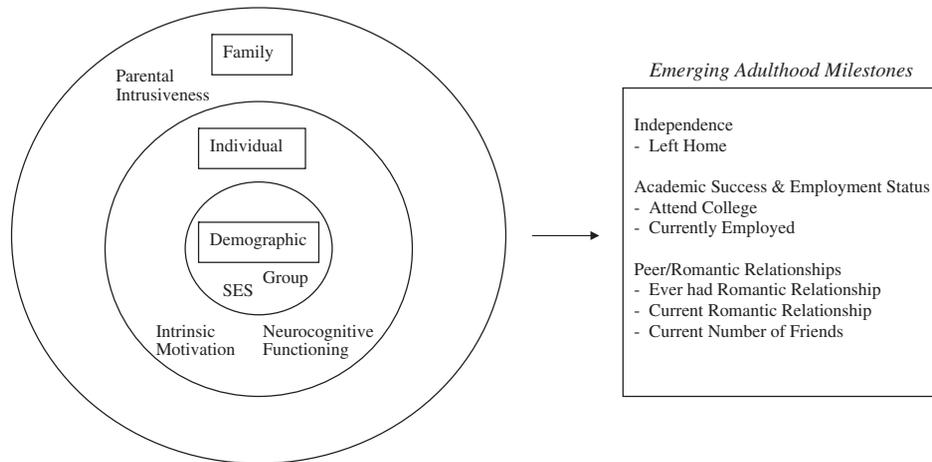


Figure 1. Adolescent predictors of emerging adult milestones.

independence, academic performance, vocational involvement, and social relationships.

In addition to individual characteristics of youth, parental fostering of independence appears to have a significant influence on one's transition to adulthood in those with chronic health conditions (Luther, 2001). Excessive parental intrusiveness or "miscarried helping" undermines a child's developing autonomy and independence (Anderson & Coyne, 1991). Previous research with the current sample suggests that parents of children with SB were significantly more intrusive than parents of typically developing peers, particularly for children with lower cognitive ability (Holmbeck, Johnson et al., 2002), and increased intrusiveness was associated with lower levels of independent decision-making.

A major goal of this study was to isolate factors that differentiate between those who are and those who are not successful in negotiating the milestones of emerging adulthood. We believe that examining the transition from adolescence to emerging adulthood is critical, and therefore chose factors from mid-adolescence as predictors of emerging adulthood milestones. We expected that our results would inform interventions to assist youth with SB in becoming full participants in the larger community of typically developing emerging adults.

We examined differential achievement of emerging adulthood milestones for youth with and without SB at the first possible time period in which youth could achieve such milestones—ages 18 and 19 years. We recognized that some youth may not have graduated from high school by this age, which would preclude achievement of certain milestones, such as attending college and leaving home. For example, since the majority of students complete high school in 4 years (Stillwell & Hoffman, 2008),

around age 18 years, some students who are still in high school at age 18 or 19 years may be considered developmentally "off-time" and therefore unable to achieve certain milestones related to independent living or financial independence (Goldscheider & Goldscheider, 1994). Thus, we conducted two sets of analyses: (a) a comparison of all youth with SB to all typically developing youth at ages 18/19 years, to examine achievement of milestones according to normative development, and (b) a comparison of youth with SB and typically developing youth who completed high school by ages 18/19 years, to examine achievement of milestones only for those who had already achieved this educational milestone.

We hypothesized that typically developing youth would be more likely to leave home, go to college, maintain current employment, and have more peer and romantic relationship experience than youth with SB. Further, given the salience of impairments in neurocognitive and social functioning associated with SB (Appleton et al., 1997; Bier et al., 1997; Fletcher et al., 2004), we hypothesized that group status would moderate relations between predictors and emerging adult milestones. That is, we expected that the relations between the predictors and the emerging adult milestones would be stronger for youth with SB.

Methods

Participants

Participants in this study were part of a larger longitudinal investigation of family relationships and psychosocial outcomes for children with and without SB (Holmbeck, Johnson et al., 2002; Holmbeck et al., 2003). Families of children with SB were recruited from three hospitals and a

statewide SB association. Families of typically developing children were recruited from schools where participating children with SB were enrolled. Six waves of data collection were conducted, starting at ages 8/9 years and occurring every 2 years. The present study used independent variables collected at Time 1 and during mid-adolescence (Time 4, ages 14/15 years) to predict emerging adult outcomes measured at Time 6 (ages 18/19 years). The initial cohort at Time 1 consisted of 68 families with an 8- or 9-year-old child with SB and a matched comparison sample of 68 typically developing children and their families. Participants in the SB and comparison samples were matched on a number of demographic variables, including age, gender, ethnicity, birth order, parental marital status, SES, and parent age (Holmbeck et al., 2003). Time 4 included 60 families of children with SB (88% of those assessed at Time 1) and 65 families from the comparison sample (96%), and Time 6 included 52 families of children with SB (76%) and 60 comparison families (88%). A comparison of families who participated at Time 6 versus families who did not participate revealed no differences with respect to gender, race, or SES for either the SB group or the comparison group.

At Time 6, the majority of participants were White (85% in SB group; 90% in comparison group). There were no differences between the SB group and the comparison group with respect to race or gender. Approximately half of the participants in both groups were male (54% of the SB group and 53% of the comparison group). The majority of mothers participated (94% of the SB group; 92% of the comparison group). Although groups were matched on SES at Time 1, there was a significant difference in SES at Time 6, as the comparison group ($M = 46.91$, $SD = 10.85$) reported higher SES compared to the SB group ($M = 42.63$, $SD = 10.49$), $t(107) = 2.08$, $p < .05$. Since the attrition analyses demonstrated no significant differences in SES for those who participated versus those who did not for either group, it appears that the comparison group's non-significant increase in SES due to attrition and the SB group's non-significant decrease in SES due to attrition led to this group difference at Time 6. Because SES was already included in the theoretical model (Figure 1), it was not necessary to include it as a covariate in analyses.

Of the participants with SB, 71% were shunted to treat hydrocephalus. Medical chart data indicated that the majority of children with SB had myelomeningocele (83%) and lesion levels were: 59% lumbosacral or lumbar, 29% sacral, and 12% thoracic. Maternal report of ambulation status at Time 1 indicated that 21% ambulated without assistance, 62% ambulated using of braces, and 17%

ambulated using a wheelchair. There were no differences with respect to shunt status, type of SB, lesion level, or ambulation between those with SB who participated at Time 6 and those who dropped out of the study.

Procedure

This study was approved by university and hospital Institutional Review Boards. At each time point from Time 1 through Time 5, data were collected during 3-hr home visits by trained graduate and undergraduate research assistants. Informed consent from parents and assent from the child were obtained at each visit, as well as release of information forms to obtain data from medical records and teachers. Families completed a set of questionnaires, which were counterbalanced to protect against order effects. Additionally, families participated in audio and videotaped interaction tasks, which began with a warm-up game, followed by an unfamiliar game task, the structured family interaction task (Ferreira, 1963), and a conflict task (Smetana, Yau, Restrepo, & Braeges, 1991) presented in a counterbalanced order (Holmbeck, Johnson et al., 2002, for a description of these interaction tasks). The current study examined the warm-up, unfamiliar game, and conflict tasks. Teachers were mailed questionnaires to complete and return, with a 95% response rate at Time 4. At Time 6, questionnaire data were collected only from the emerging adult participants via mail (i.e., home visits were not conducted). At each time point, participants received monetary compensation for their time.

Measures

Demographics

The Parent Demographic Questionnaire, developed for this study, was used to assess factors such as the child's age, parents' education level, and parents' occupation. The Hollingshead Four Factor Index of socioeconomic status, based on parental education and occupational status, was used to assess SES at Time 1 (Hollingshead, 1975). SES was derived by assigning a score to mothers' and/or fathers' occupations and education level. For two-parent families, caregivers' results were averaged to calculate the family SES.

Neurocognitive Functioning

Receptive verbal ability was measured using the Peabody Picture Vocabulary Test-Revised Edition (PPVT-R, Dunn & Dunn, 1981) at Time 1. The PPVT-R has high levels of validity and reliability, correlating moderately with other measures of verbal intelligence (Sattler, 2002).

Executive functioning at Time 4 was measured via mother and teacher report on the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 1998) and adolescent performance on the Cognitive Assessment System (CAS; Naglieri & Das, 1997). The BRIEF is a multidimensional measure of executive functions, including the ability to initiate behavior, plan and organize strategies to solve complex problems, and monitor and evaluate behavior (Gioia et al., 1998). For this study, items from a pre-publication version of the BRIEF were administered to mothers and teachers, with permission from the authors and publisher. Five of the nine subscales from this early edition of the BRIEF were selected for use in the current study due to their high factor loadings on the “executive” factor across both parent and teacher reports: Initiate ($\alpha = .86$ for mother report and $.88$ for teacher report), Sustain ($\alpha = .83$ for mother report and $.86$ for teacher report), Organize ($\alpha = .92$ for mother report and $.95$ for teacher report), Plan ($\alpha = .90$ for mother report and $.94$ for teacher report), and Working Memory ($\alpha = .88$ for mother report and $.93$ for teacher report). For each item, mothers and teachers selected whether the behavior was “never, sometimes, or often” a problem for the adolescent. Since norms were not available for this prepublication version, the mean score across all items was utilized in this study, with higher scores indicative of greater impairment.

The CAS (Naglieri & Das, 1997) is an objective, standardized neuropsychological measure of attention and executive functioning, and was administered at Time 4. The Planning scale standardized score (mean of 100, *SD* of 15) was used for this study and includes three subtests (Matching Numbers, Planned Codes, and Planned Connection), which require initiation, planning, and execution of effective problem-solving strategies while sustaining attention. This scale has demonstrated high reliability (average coefficient = $.88$) and high test–retest stability (average $r = .85$; Naglieri & Das, 1997). The CAS Planning scale has been shown to correlate moderately with IQ ($r = .33$ – $.53$ for WISC-III VIQ, PIQ, and FSIQ; Naglieri & Das, 1997).

Intrinsic motivation

The Harter Scale of Intrinsic Versus Extrinsic Orientation in the Classroom (Harter, 1981) is a 10-item questionnaire that was completed by teachers at Time 4. Teachers were presented with two alternative statements about what students are like (e.g., “this pupil prefers easy work he/she is sure he/she can do OR this pupil likes hard work that is challenging”) and were asked to rate which one is

most true for their student by marking “Really True or Sort of True,” in the box next to the statement that best described the student. Adequate psychometric properties have been established for this measure (Harter, 1981), and this scale demonstrated good reliability at Time 4 ($\alpha = .80$).

Parental Intrusiveness

Parental intrusiveness was examined via coding of observed interactions between mothers and adolescents at Time 4.¹ Trained research assistants coded the family interaction tasks using a 4-item coding system developed by Johnson & Holmbeck (1995; Holmbeck, Johnson et al., 2002). This coding system examines several dimensions of intrusiveness including (a) parental prevention of independent behavior, (b) infantilization, and (c) excessive parental control. Each interaction task was viewed by two coders and the items were rated on a 5-point Likert scale. The score for each item reflects the mean of the two coders’ scores. The codes reflect excessive (rather than normative) levels of parental intrusiveness. Sufficient inter-rater (intraclass $r = .78$ and $.66$ for SB and comparison groups, respectively) and scale ($\alpha = .80$ and $.78$ for SB and comparison groups, respectively) reliabilities have been established (Holmbeck, Johnson et al., 2002).

Independence, Academic Achievement, and Employment Status

Emerging adults completed a demographic questionnaire developed for this study. The questionnaire asked youth where they are currently living (e.g., with parents, in a dormitory, in an apartment, etc.). Leaving home by ages 18/19 years (Time 6) was considered a discrete outcome. The questionnaire also assessed college attendance and current employment status.

Romantic and Peer Relationships

Romantic relationship experience and current romantic relationship status were assessed with one item asking emerging adults to report whether they had ever been involved in a romantic relationship (yes/no) and whether they were currently involved in a romantic relationship (yes/no). One item from the Adult Self-Report (ASR) version of the Achenbach Behavior Checklist was used to assess number of friends as a measure of peer relationships. The item is scored using a 4-point Likert-scale,

¹In Holmbeck, Johnson et al. (2002), this parenting behavior was referred to as “parental overprotectiveness.” Given the pejorative nature of this term, we now use the term “parental intrusiveness” to refer to the same cluster of parenting behaviors.

with 0 = "none," 1 = "1 friend," 2 = "2 or 3 friends," and 3 = "4 or more friends."

Data Analyses

Analyses were conducted to examine two types of comparisons: (a) the full sample of all youth with and without SB at ages 18/19 years to examine the achievement of milestones based on normative development, and (b) the subsample of youth with and without SB who completed high school by ages 18/19 years to examine achievement of milestones based on the opportunity to achieve the milestone (e.g., college attendance is precluded by being in high school). First, group differences on the predictor variables are reported using independent sample *t*-tests. Second, group differences in the frequency of achieving the emerging adult milestones are reported using Pearson chi-square analyses for discrete outcomes and an independent samples *t*-test for number of friends. The number of close friends variable was negatively skewed; therefore, scores were reflected and then transformed using a square root transformation. The transformed variable was not skewed and was used in all analyses; however, the mean scores presented are in the original scaling so that higher scores represent more friends. Third, predictors of emerging adult milestones were examined using logistic and multiple linear regression techniques. Group status (i.e., SB vs. typically developing) was examined as a moderator of the relation between predictor variables and emerging adult milestones. Based on Bronfenbrenner's social-ecological theory (1979), we tested a model that included demographic predictors entered in a stepwise fashion in the first block (main effects), individual predictors entered stepwise in the second block (main effects), the family predictor entered in the third block (main effects), and group \times predictor interaction effects entered stepwise in the next three blocks following the same order as the main effects, with nonsignificant effects trimmed. Logistic regression was used for the discrete outcomes (i.e., leaving home, attending college, current employment status, romantic relationship experience, and current romantic relationship) and multiple regression was used for the continuous number of friends outcome. A likelihood ratio forward selection criterion was used (see Best, Streisand, Catania, & Kazak, 2001 and DeLambo, Ievers-Landis, Drotar, & Quittner, 2004 for examples of studies using the forward selection method), and the model was trimmed by eliminating nonsignificant predictors. To reduce multicollinearity between the predictor variables and group status and to facilitate interpretation of the interaction effects, all continuous predictor

variables were centered prior to conducting analyses (Holmbeck 1997, 2002). When significant interaction effects were observed, post hoc probing of significant moderational effects was conducted according to the procedure described by Holmbeck (2002).

Results

Group Difference Analyses of Predictors and Emerging Adulthood Milestones

Group Differences for Predictors

Independent samples *t*-tests revealed significant group differences between youth with SB and comparison youth on every independent predictor. Specifically, compared to typically developing youth, youth with SB demonstrated lower levels of SES [SB $M = 42.63$; Comparison $M = 46.91$; $t(107) = -2.08$, $p < .05$], poorer performance on the PPVT-R [SB $M = 93.14$; Comparison $M = 109.53$; $t(109) = -5.31$, $p < .01$] and the CAS Planning scale [SB $M = 75.52$; Comparison $M = 101.72$; $t(99) = -8.45$, $p < .01$], greater executive function problems on the BRIEF [Mother report: SB $M = 1.84$; Comparison $M = 1.63$; $t(105) = 2.55$, $p < .05$; Teacher report: SB $M = 1.62$; Comparison $M = 1.37$; $t(81.60) = 2.60$, $p < .05$], lower levels of intrinsic motivation [SB $M = 2.17$; Comparison $M = 2.56$; $t(101) = -3.91$, $p < .01$], and higher levels of maternal intrusiveness [SB $M = 14.77$; Comparison $M = 12.63$; $t(97) = 3.96$, $p < .01$]. When comparing only youth who had graduated from high school, differences followed the same pattern, except there were no significant differences for SES or teacher report on the BRIEF between youth with SB and comparison youth.

Emerging Adulthood Milestones

The frequencies of leaving home, attending college, current employment, romantic relationship experience, and current romantic relationship status, as well as the mean score on the number of friends item, are reported in Table 1. Based on odds ratios for all youth at ages 18/19 years, typically developing youth were 3.67 times more likely to leave home $\chi^2(1) = 9.60$, $p < .01$, 3.33 times more likely to attend college $\chi^2(1) = 9.33$, $p < .01$, 2.20 times more likely to be employed $\chi^2(1) = 4.11$, $p < .05$, 4.24 times more likely to have had romantic relationship experience $\chi^2(1) = 8.25$, $p < .01$, and 1.48 times more likely to currently be in a romantic relationship $\chi^2(1) = 0.75$, $p > .05$, compared to youth with SB. Emerging adults with and without SB reported a similar number of close friends, $t(108) = .84$, $p > .05$. When only youth who had completed high school were included in

Table I. Achievement of Emerging Adult Milestones by Age 18/19 (Time 6)

Milestone	All participants ^a			Only participants who completed high school ^b		
	SB <i>n</i> (%) or <i>M</i> (<i>SD</i>)	Comparison <i>n</i> (%) or <i>M</i> (<i>SD</i>)	Group difference	SB <i>n</i> (%) or <i>M</i> (<i>SD</i>)	Comparison <i>n</i> (%) or <i>M</i> (<i>SD</i>)	Group difference
Left home	11 (22%)	30 (51%)	$\chi^2 = 9.60^{**}$	11 (34%)	29 (53%)	$\chi^2 = 2.74$
Currently in college	21 (41%)	42 (70%)	$\chi^2 = 9.33^{**}$	21 (66%)	42 (75%)	$\chi^2 = 0.88$
Currently employed	22 (44%)	38 (63%)	$\chi^2 = 4.11^*$	16 (50%)	35 (63%)	$\chi^2 = 1.31$
Currently in romantic relationship	20 (59%)	36 (68%)	$\chi^2 = 0.75$	16 (69%)	34 (68%)	$\chi^2 = 0.02$
Ever had romantic relationship experience	34 (68%)	54 (90%)	$\chi^2 = 8.25^{**}$	23 (72%)	50 (89%)	$\chi^2 = 4.37^*$
Current number of close friends item	2.38 (0.70)	2.48 (0.60)	$t(108) = .84$	2.41 (0.71)	2.48 (0.60)	$t(86) = .53$

Note. Current number of close friends item score ranges from 0 to 3, with higher scores representing more friends.

^a*n* = 50–51 for SB group and *n* = 59–60 for Comparison group.

^b*n* = 32 for SB group and *n* = 55–56 for Comparison group except *n* = 23 for SB group and *n* = 50 for Comparison group for “Currently in Romantic Relationship” due to missing data.

p* < .05; *p* < .01.

Table II. Logistic and Multiple Regressions Predicting achievement of Emerging Adult Milestones

Dichotomous Outcomes	Model step	All participants ^a				Only participants who completed high school ^b				
		<i>B</i>	Exp (<i>B</i>)	Wald	Δ -2LL	<i>B</i>	Exp (<i>B</i>)	Wald	Δ -2LL	
Left Home	1. Group	-1.26	.28	7.94	8.57**	1. Group	-.66	.52	1.91	1.95
	2. Teacher BRIEF	-1.47	.23	5.94	7.22**	2. Teacher BRIEF	-1.56	.21	6.47	8.03**
						3. Group \times Teacher BRIEF	2.99	.70	4.75	5.40*
Attend College	1. SES	.12	1.12	21.16	28.35**	1. SES	.13	1.14	17.96	25.61**
	2. Group	-1.13	.32	5.17	5.34*	2. PPVT-R	.06	3.46	13.78	8.59**
	3. CAS Planning	.06	1.06	9.72	11.96**					
	4. Group \times SES	-.15	.86	4.99	5.77*					
Currently Employed	1. Intrinsic Motivation	.98	2.68	5.99	6.52*	No significant predictors				
Ever had Romantic Relationship Experience	1. Group	-1.44	.24	7.20	7.95**	1. Group	-1.24	.29	4.39	4.51*
	2. Mother BRIEF	-1.44	.24	5.22	5.56*	2. Mother BRIEF	-1.76	.17	5.53	6.11*
	3. Mother Intrusiveness	-.33	.72	8.98	10.23**	3. Mother Intrusiveness	-.33	.72	5.88	6.72**
Currently in Romantic Relationship	No significant predictors				No significant predictors					
Continuous Outcome	Model step	<i>B</i>	<i>SE B</i>	<i>B</i>	ΔR^2	Model step	<i>B</i>	<i>SE B</i>	<i>B</i>	ΔR^2
Current Number of Close Friends Item	1. SES	.01	.01	.16	.02	1. Mother BRIEF	-.44	.13	-.35	.12**
	2. Group	-.03	.11	-.03	.00					
	3. Mother BRIEF	-.33	.12	-.27	.07**					
	4. Group \times SES	.03	.01	.36	.07**					

Note. ^a*n* = 98–102.

^b*n* = 73–86 due to missing data.

p* < .05; *p* < .01.

analyses, only the group difference in romantic relationship experience remained significant, $\chi^2(1) = 4.37$, $p < .05$, odds ratio = 3.26.

Independence Milestone: Leaving Home

The results of a logistic regression predicting leaving home for all participants and only for participants who completed high school are included in Table II. For all participants,

group status and adolescents' attention and executive function abilities as measured by teacher report on the BRIEF at Time 4 significantly predicted leaving home at Time 6, $\chi^2(2, 99) = 15.78$, $p < .01$, indicating that youth without SB and youth with better executive function were more likely to leave home. For participants who completed high school, adolescents' attention and executive function abilities as measured by teacher report on the BRIEF at

Time 4 again significantly predicted leaving home at Time 6. Additionally, there was a significant Group \times Teacher BRIEF interaction, $\chi^2(1, 79) = 5.40, p < .05$. To understand the interaction, two categories of functioning on the teacher BRIEF were created using a median split - low and high dysfunction. There were no significant differences between low and high levels of executive dysfunction for the SB group, $\chi^2(1, 43) = .34, p > .05$, but comparison youth with lower levels of executive dysfunction were more likely to have left home, $\chi^2(1, 54) = 13.39, p < .01$.

Academic and Employment Milestones

Attending College

As can be seen in Table II, there were significant main effects for SES, group, and CAS Planning, with higher planning abilities, higher SES, and membership in the comparison group increasing the odds of attending college, $\chi^2(4, 94) = 51.42, p < .01$. Further, there was a significant Group \times SES interaction. Post hoc analyses indicated that high SES was associated with increased odds of attending college for both the SB and comparison groups, though the relationship reached a higher level of significance for youth from the comparison group, $\chi^2(1, 58) = 17.19, p < .01$, compared to youth with SB, $\chi^2(1, 48) = 5.15, p < .05$. With regard to participants who completed high school, there were significant main effects for SES and PPVT-R scores, with higher levels of each associated with increased odds of attending college, $\chi^2(2, 84) = 34.21, p < .01$.

Current Employment

As indicated in Table II, intrinsic motivation emerged as a significant main effect, with higher intrinsic motivation increasing the odds of currently being employed, $\chi^2(1, 101) = 6.52, p < .05$. With regard to participants who completed high school, there were no significant predictors.

Romantic and Peer Relationship Milestones

Romantic Relationship Experience

As presented in Table II, group, executive function ability as measured by mother report on the BRIEF, and maternal intrusiveness were significant predictors, with membership in the comparison group, lower executive dysfunction, and lower parental intrusiveness increasing the odds of ever experiencing a romantic relationship, $\chi^2(3, 96) = 23.77, p < .01$. For youth who completed high school, the same three significant predictors emerged, $\chi^2(3, 78) = 17.34, p < .01$. With regard to current romantic relationship status, no significant predictors emerged

for the full sample or for participants who completed high school.

Number of Friends

As can be seen in Table II, attention and executive function ability as measured by mother report on the BRIEF was a significant main effect, with lower executive dysfunction predicting greater number of friends, $\beta = -.27, t = 2.75, p < .01$. Further, there was a significant interaction between group and SES. The model accounted for 16.6% of the variance in number of friends, $F(4,97) = 4.83, p < .01$. Post hoc probing indicated that in the SB group, higher SES predicted a greater number of friends ($\beta = .42, t = 2.83, p < .01$); this relation was not significant in the comparison group. With regard to participants who completed high school, maternal report of executive function ability on the BRIEF was the only significant predictor, with lower levels of dysfunction predicting a greater number of friends, $R^2 = .12, F(1,83) = 11.33, p < .01$.

Discussion

The purpose of this study was to evaluate the predictive utility of demographic, individual, and family-based factors during adolescence for achievement of emerging adulthood milestones for youth with and without SB. Results demonstrated that youth with SB did not achieve as many emerging adulthood milestones as their typically developing peers by age 18–19 years. Emerging adults with SB were less likely to leave home, attend college, maintain employment, and have romantic relationship experience, consistent with our first hypothesis. However, there were no significant differences between the groups in terms of number of peer friendships, suggesting that adolescents with SB may demonstrate resilience in terms of number of friends by emerging adulthood.

Rates of leaving home, being employed, and attending college for our sample of emerging adults with SB were similar to rates found in other samples of youth with SB (Bowman et al., 2001; McDonnell & McCann, 2000). Similarly, rates for achieving these milestones within our comparison group were comparable to other studies of typically developing emerging adults (Arnett, 2000; Cohen et al., 2003). Rates of romantic relationship experience were slightly higher for our SB sample compared to a previous sample (68% vs. 54%, Verhoef et al., 2005), though the previous sample included some younger youth (ages 16–25 years). Within our comparison sample, almost all emerging adults (90%) reported romantic relationship experience. Although these results indicated group differences across most emerging adulthood

milestones, just one significant group difference emerged when considering only the participants who had completed high school by age 18 or 19 years. That is, among youth who completed high school, youth with SB were less likely to have ever had a romantic relationship compared to typically developing youth.

Clearly, youth with SB are not achieving emerging adult milestones “on time,” but it appears that they may eventually achieve rates of milestone success similar to those of their typically developing peers. In other words, when we only looked at youth who had had the opportunity to achieve these milestones by completing high school, there were few significant differences between youth with SB and typically developing youth. Therefore, this study is only a starting point for research in this area—these emerging adults need to be followed into early adulthood to determine whether all milestones will be met for youth with SB.

Bronfenbrenner’s (1979) social–ecological theory provided a useful framework for identifying risk factors for failure to achieve emerging adulthood milestones. Consistent with this framework, our results demonstrate that multiple factors were associated with the achievement of developmental milestones, including more proximal demographic and individual factors (e.g., SES, executive functioning, and intrinsic motivation) and more distal factors, such as parenting behavior. Contrary to our second hypothesis, there were very few relations in which group status served as a moderator, suggesting that the predictor variables outlined in our model are important for all youth. Since youth with SB tended to score lower on these predictor variables, this may also explain their lower success rates with the milestones of emerging adulthood. Thus, these individual and family predictors suggest some potentially modifiable targets for interventions that could facilitate milestone achievement.

Executive functioning abilities emerged consistently as an important intra-individual predictor across milestones and the two types of analyses. Executive skills, such as planning, flexible problem-solving, initiating, and shifting and sustaining attention, seem to be important skills for living independently and managing social and academic demands. Results also indicated that different measures of executive function were important in predicting achievement of different milestones. That is, an objective performance measure of executive functioning (CAS) was a significant predictor for college attendance, while mother or teacher behavioral reports of executive functioning (BRIEF) were significant predictors for leaving home, romantic relationship experience, and number of friends. These findings suggest that rating scales may be more

applicable for identifying executive functioning weaknesses in interpersonal realms or managing daily tasks (Mangeot, Armstrong, Colvin, Yeates, & Taylor, 2002), whereas objective, performance-based measures may be more applicable to achievement-related domains (e.g., attending college).

Intrinsic motivation and maternal intrusiveness emerged as significant intra-individual and family predictors of current employment and previous relationship experience, respectively. Intrinsic motivation may be particularly important for both initially obtaining employment and successfully maintaining employment, as employment often requires the ability to independently work towards goals in the absence of consistent external monitoring and immediate external rewards. Intrinsic motivation has also been linked to better academic performance in school (Ryan & Deci, 2000), which may translate to greater employment and career achievements. Findings from this study also suggest that, regardless of group status, youth with intrusive parents are less likely to have romantic relationship experience. Excessive parental intrusiveness may be an example of “miscarried helping” (Anderson & Coyne, 1991), whereby parenting behaviors that are initially well intentioned (e.g., protecting youth from unwanted sexual advances or from engaging in risky sexual behavior) can eventually undermine a normative aspect of youth’s social development. It is also possible that parents are more intrusive when children are displaying social problems or that intrusiveness undermines opportunities for social engagement. Further research is needed to evaluate the validity of such speculations.

Although not readily modifiable, higher SES emerged as a protective demographic factor for college attendance and number of friendships. Families with greater financial means are more likely to be able to afford higher education opportunities for their children and parental level of education has been directly and indirectly linked to child’s educational achievement (Davis-Kean, 2005). The finding that higher SES was associated with greater number of friends for youth with SB, but not for the comparison sample, suggests that resources associated with higher SES may be especially beneficial for youth with SB. It is possible that youth from families with higher SES have greater resources to engage with peers, such as belonging to a greater number of clubs, sports teams, and after-school programs, as well as access to transportation. Therefore, when working with families with a child with SB, it is important to provide information regarding community resources.

The current study is one of the first longitudinal studies to explore developmental predictors of emerging adult milestones in youth with SB. Although the study has

several important strengths, there are also several limitations. The number of predictors included in the initial regression analyses was large for the sample size; however, given the lack of previous literature and theory in this area, it was deemed important to analyze the utility of different predictors within the individual and family domains. Another limitation was the use of the PPVT-R as a proxy for intellectual functioning, which was only measured at Time 1. Although the PPVT-R has been moderately correlated with other measures of verbal intelligence, it is not a measure of IQ. Further, the use of self-reported number of friendships is a limited proxy for social engagement; thus, future studies should examine quality and reciprocity of friendships. The assessment of romantic relationship experience relies on retrospective report (i.e., some youth may have experienced a romantic relationship years prior to this evaluation), limiting our interpretations in this area. Our sample was predominately Caucasian, similar to much of the existing literature on emerging adulthood, which is based on college-attending, middle-class Caucasian youth (Arnett 2000). Future studies would benefit from sampling more diverse youth and examining how achievement of milestones may be affected by racial and cultural factors. Additionally, more distal environmental and community factors were not explored as potential barriers to achieving emerging adult milestones. Because individuals with disabilities often have difficulty with the ability to drive, ambulate in public places, and access transportation, and these difficulties have been associated with poorer quality of life (Vogel, Klaas, Lubicky, & Anderson, 1998), future studies should examine how these barriers impact achievement of milestones.

In addition to the clinical implications already discussed, results of this study suggest that executive function abilities, intrinsic motivation, and parental intrusiveness are critical to assess during early to mid-adolescence in this population. Executive dysfunction appears to be particularly important, as it emerged as a predictor of multiple emerging adult milestones (i.e., leaving home, attending college, and engaging in a romantic relationship) across both types of analyses. School- and home-based interventions could target executive functioning via a focus on organizational skills, study skills, or by encouraging the use of aids, such as daily planners (Barkley, 1998; Dawson & Guare, 2009). Further, clinicians and physicians should discuss developmental milestones and partner with parents to foster their child's autonomy, sense of mastery in career and academic areas of interest, and engagement in peer friendships and romantic relationships. Family therapy may help facilitate supportive, rather than intrusive,

parenting, as well as teach parents behavioral strategies to promote development.

In summary, youth with SB have difficulty achieving emerging adult milestones within the same time frame as their peers. Youth with greater executive functioning and intrinsic motivation are more likely to be successful in achieving various milestones. Parents, teachers, and schools can promote development by fostering intrinsic motivation, addressing executive difficulties, and helping youth build positive social relationships.

Funding

This research was supported by grants from the March of Dimes Birth Defects Foundation (12-FY01-0098) and the National Institute of Child Health and Human Development (R01HD048629). This research represents a longitudinal study, and methods of this study were first reported in Holmbeck et al. (2002, 2003).

Conflicts of interest: None declared.

References

- Anderson, B. J., & Coyne, J. C. (1991). "Miscarried helping" in the families of children and adolescents with chronic diseases. In J. H. Johnson, & S. B. Johnson (Eds.), *Advances in child health psychology* (pp. 167–177). Gainesville: University of Florida.
- Appleton, P. L., Ellis, N. C., Minchom, P. E., Lawson, V., Boll, V., & Jones, P. (1997). Depressive symptoms and self-concept in young people with SB. *Journal of Pediatric Psychology*, 22, 707–722.
- Arnett, J. J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist*, 55, 469–480.
- Arnett, J. J. (2006). Emerging adulthood: Understanding the new way of coming of age. In J. J. Arnett, & J. L. Tanner (Eds.), *Emerging adults in America: Coming of age in the 21st century* (pp. 3–19). Washington, DC: American Psychological Association.
- Barkley, R. A. (1998). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment* (2nd edn). New York: Guilford Press.
- Best, M., Streisand, R., Catania, L., & Kazak, A. E. (2001). Parental distress during pediatric leukemia and posttraumatic stress symptoms (PTSS) after treatment ends. *Journal of Pediatric Psychology*, 26, 299–307.

- Bier, J. B., Morales, Y., Liebling, J., Geddes, L., & Kim, E. (1997). Medical and social factors associated with cognitive outcome in individuals with myelomeningocele. *Developmental Medicine and Child Neurology*, 39, 263–266.
- Bowman, R. M., McLone, D. G., Grant, J. A., Tomita, T., & Ito, J. A. (2001). SB outcome: A 25-year prospective. *Pediatric Neurosurgery*, 34, 114–120.
- Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.
- Centers for Disease Control and Prevention [CDC] (2008). Quick-stats: SB and anencephaly rates—United States, 1991, 1995, 2000, and 2005. *MMWR Weekly*, 57, 15.
- Charney, E. B. (1992). Neural tube defects: SB and myelomeningocele. In M. L. Batshaw, & Y. M. Perret (Eds.), *Children with disabilities: A medical primer* (3rd edn, pp. 471–488). Baltimore: Paul H. Brookes Publishing.
- Cohen, P., Kasen, S., Chen, H., Hartmark, C., & Gordon, K. (2003). Variations in patterns of developmental transitions in the emerging adulthood period. *Developmental Psychology*, 39, 657–669.
- Collins, W. A., & Van Dulmen, M. (2006). “The course of true love(s)...”: Origins and pathways in the development of romantic relationships. In A. Booth, & A. C. Crouter (Eds.), *Romance and sex in adolescence and emerging adulthood: Risks and opportunities* (pp. 63–86). Mahwah, NJ: Erlbaum.
- Collins, W. A., Welsh, D. P., & Furman, W. (2009). Adolescent romantic relationships. *Annual Review of Psychology*, 60, 631–652.
- Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. *Journal of Family Psychology*, 19, 294–304.
- Dawson, P., & Guare, R. (2009). *Smart but scattered: The revolutionary “executive skills” approach to helping kids reach their potential*. New York: Guilford Press.
- DeLambo, K. E., Ievers-Landis, C. E., Drotar, D., & Quittner, A. L. (2004). Association of observed family relationship quality and problem-solving skills in treatment adherence in older children and adolescents with cystic fibrosis. *Journal of Pediatric Psychology*, 29, 343–353.
- Dunn, L. M., & Dunn, L. M. (1981). Peabody picture vocabulary test-revised (PPVT-R). Circle Pines, MN: American Guidance Service.
- 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., Barnes, M. A., Hannay, H. J., Landry, S., . . . Francis, D. J. (2004). Spina bifida: Genes, brain, and development. In L. M. Glidden (Ed.), *International review of research in mental retardation* (Vol. 29, pp. 63–117). San Diego: Elsevier Academic Press.
- Furman, W., Simon, V. A., Shaffer, L., & Bouchev, H. A. (2002). Adolescents’ working models and styles for relationships with parents, friends, and romantic partners. *Child Development*, 1, 241–255.
- Gerhardt, C. A., Vannatta, K., Valerius, K. S., Correll, J., & Noll, R. B. (2007). Social and romantic outcomes in emerging adulthood among survivors of childhood cancer. *Journal of Adolescent Health*, 40, 462.e9–462.e15.
- Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (1998). *Development of the behavior rating inventory of executive function (BRIEF)*. Odessa, FL: Psychological Assessment Resources.
- Goldscheider, F., & Goldscheider, C. (1994). Leaving and returning home in 20th century America. *Population Bulletin*, 48, 1–35.
- Harter, S. (1981). A new self-report scale of intrinsic versus extrinsic orientation in the classroom: Motivational and informational components. *Developmental Psychology*, 17, 300–312.
- Hetherington, R., Dennis, M., Barnes, M., Drake, J., & Gentili, F. (2006). Functional outcome in young adults with SB and hydrocephalus. *Childs Nervous System*, 22, 117–124.
- 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). Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *Journal of Pediatric Psychology*, 27, 87–96.
- Holmbeck, G. N., Coakley, R. M., Hommeyer, J. S., Shapera, W. E., & Westhoven, V. C. (2002). Observed and perceived dyadic and systemic functioning in families of preadolescents with spina bifida. *Journal of Pediatric Psychology*, 27, 177–189.
- Holmbeck, G. N., & Faier-Routman, J. (1995). Spinal lesion level, shunt status, family relationships, and psychosocial adjustment in children and adolescents

- with SB myelomeningocele. *Journal of Pediatric Psychology*, 20, 817–832.
- Holmbeck, G. N., Johnson, S. Z., Wills, K. E., McKernon, W., Rose, B., Erklin, S., & Kemper, T. (2002). Observed and perceived parental overprotection in relation to psychosocial adjustment in preadolescents with a physical disability: The mediational role of behavioral autonomy. *Journal of Consulting and Clinical Psychology*, 70, 96–110.
- Holmbeck, G. N., Westhoven, V. C., Phillips, W. S., Bowers, R., Gruse, C., Nikolopoulos, T., & Totura, C. M. W. (2003). A multimethod, multi-informant, and multidimensional perspective on psychosocial adjustment in preadolescents with SB. *Journal of Consulting and Clinical Psychology*, 71, 782–796.
- Johnson, S. Z., & Holmbeck, G. N. (1995). *Manual for overprotectiveness coding system*. Unpublished manual, Loyola University Chicago.
- Kazak, A. E., Rourke, M. T., & Navsaria, N. (2009). Families and other systems in pediatric psychology. In M. C. Roberts, & R. G. Steele (Eds.), *Handbook of pediatric psychology* (4th edn, pp. 656–671). New York: Guilford Press.
- Luther, B. (2001). Age-specific activities that support successful transition to adulthood for children with disabilities. *Orthopaedic Nursing*, 20, 23–29.
- Mangeot, S., Armstrong, K., Colvin, A. N., Yeates, K. O., & Taylor, H. G. (2002). Long-term executive function deficits in children with traumatic brain injuries: Assessment using the Behavior Rating Inventory of Executive Function (BRIEF). *Child Neuropsychology*, 8, 271–284.
- McDonnell, G. V., & McCann, J. P. (2000). Link between the CSF shunt and achievement in adults with SB. *Journal of Neurology, Neurosurgery, and Psychiatry*, 68, 800.
- Naglieri, J. A., & Das, J. P. (1997). *Cognitive assessment system*. Itasca, IL: Riverside Publishing.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25, 54–67.
- Sattler, J. M. (2002). *Assessment of children: Behavioral and clinical applications* (4th edn). La Mesa, CA: Jerome M. Sattler.
- Smetana, J. G., Yau, J., Restrepo, A., & Braegas, J. L. (1991). Adolescent-parent conflict in married and divorced families. *Developmental Psychology*, 27, 1000–1010.
- Stillwell, R., & Hoffman, L. (2008). *Public school graduates and dropouts from the common core of data: School year 2005–06* (NCES 2008-353rev), National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC. Retrieved from <http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008353rev>.
- Verhoef, M., Barf, H. A., Vroeghe, J. A., Post, M. W., van Asbeck, F. W., Gooskens, R. H., & Prevo, A. J. (2005). Sex education, relationships, and sexuality in young adults with SB. *Archives of Physical Medicine and Rehabilitation*, 86, 979–987.
- Vogel, L. C., Klaas, S. J., Lubicky, J. P., & Anderson, C. J. (1998). Long-term outcomes and life satisfaction of adults who had pediatric spinal cord injuries. *Archives of Physical Medicine and Rehabilitation*, 79, 1496–1503.
- Wills, K. E., Holmbeck, G. N., Dillon, K., & McClone, D. G. (1990). Intelligence and achievement in children with myelomeningocele. *Journal of Pediatric Psychology*, 15, 161–176.