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Survivors of Childhood Cancer and Comparison Peers: The Influence of Peer Factors on Later Externalizing Behavior in Emerging Adulthood*

Amanda L. Thompson,[1] PhD, Cynthia A. Gerhardt,[1] PhD, Kimberly S. Miller,[1] MA, Kathryn Vannatta,[1] PhD, and Robert B. Noll,[2] PhD

[1]Center for Biobehavioral Health, The Research Institute at Nationwide Children's Hospital and The Ohio State University and [2]Child Development Unit, Children's Hospital of Pittsburgh

Objective To examine group differences and predictors of externalizing behavior and substance use during the transition to emerging adulthood (i.e., ages 18–25) among survivors of childhood cancer and comparison peers. **Methods** Peer acceptance and social behavior were assessed in classrooms of 55 children (ages 8–15) during cancer treatment. Children with cancer, comparison peers (n = 60), and parents completed measures of externalizing behavior and/or substance use during an initial home visit and soon after participants turned 18. **Results** At follow-up, survivors and peers exhibited similar externalizing behaviors and substance use, except peers were more likely to use marijuana. Substance use was associated with earlier peer acceptance and social behavior. Survivors who were older at diagnosis were at greater risk for later externalizing behavior and substance use. **Conclusions** Mean externalizing behaviors and substance use generally fell within normative ranges for both survivors and peers. Some survivors may benefit from interventions to reduce risk behavior.

Key words cancer; externalizing behavior; peer relationships; substance use.

Five-year survival rates for childhood cancer now exceed 75% (Ries et al., 2004), and it is estimated that 1 in 640 young adults is a survivor of childhood cancer (Lipschitz, Weiner, & Hewitt, 2005). However, survivors may experience health complications or physical late effects, including organ damage, functional impairment, and secondary malignancies, that may affect long-term quality of life (Bhatia & Landier, 2005). These late effects contribute to a mortality rate among survivors that is nearly 11 times higher than the general US population (Mertens et al., 2001). As such, lifestyle behaviors that exacerbate or attenuate risk for physical late effects have become a focus of researchers and healthcare providers. Investigation of these behaviors during emerging adulthood (i.e., ages 18–25) may be particularly critical, as this developmental period is characterized by significant change, instability, identity exploration, and experimentation (Arnett, 2000).

As children progress through adolescence and into emerging adulthood, they strive for autonomy and may begin to take a larger role in their health (Williams, Holmbeck, & Greenley, 2002). At the same time, they may test limits and experiment with health compromising behaviors. Some involvement in externalizing behaviors (i.e., aggressive, oppositional, and delinquent behaviors such as fighting, lying) and substance use is considered typical in adolescence and emerging adulthood, particularly among males (Centers for Disease Control [CDC], 2008; Johnston, O'Malley, & Bachman, 1999). Rates of delinquent behavior peak in late adolescence (Moffit, 1993),

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All correspondence concerning this article should be addressed to Cynthia A. Gerhardt, PhD, The Research Institute at Nationwide Children's Hospital, Center for Biobehavioral Health, Rm. JW4992, 700 Children's Drive, Columbus, OH 43205-2696, USA. E-mail: cynthia.gerhardt@nationwidechildrens.org.

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and by 12th grade, three-quarters of adolescents have used alcohol, over half have used tobacco, and one-quarter have used illicit drugs (CDC, 2008; Johnston et al., 1999).

Externalizing behaviors and substance use increase risk for a variety of negative outcomes (e.g., STDs, accidents), and risk for adverse consequences may be magnified for survivors due to their compromised health status (Bhatia & Landier, 2005; Mertens, et al., 2002). Involvement in externalizing behavior and substance use could amplify organ damage or increase risk for second malignancies. Thus, even developmentally typical risk behavior can have significant consequences for survivors.

Although there is a growing literature on young adult survivors of childhood cancer in multiple domains of functioning (e.g., social, academic), there is relatively little on externalizing behaviors. Studies have largely focused on younger cohorts of survivors or have restricted assessment to substance use alone. There is some evidence that children with cancer and long-term survivors may be less prone to externalizing behaviors than peers (Noll et al., 1999; Stam, Grootenhuis, & Last, 2005), as treatment side effects (e.g., fatigue, growth delays), hospitalizations, and increased parental monitoring may limit opportunities for acting out. With regard to substance use, some studies report survivors may be at lower risk for alcohol, tobacco, and drug use (Emmons et al., 2002; Larcombe, Mott, & Hunt, 2002; Stam et al., 2005; Tyc, Hadley, & Crockett, 2001), while others report they use substances at rates similar to siblings, peers, or normative samples (Haupt et al., 1992; Hollen & Hobbie, 1996; Mulhern et al., 1995).

Conflicting findings may result from differences in the use of comparison groups, measurement strategies (e.g., interview vs. pencil/paper measures), attention to medical variables, and participant ages. Many studies have included survivors who are 18- to 30-years old, which may mask developmental differences in substance use during emerging and young adulthood. Experimentation is often initiated in adolescence, peaks during emerging adulthood, and declines sharply in the late 20s (Baer, McLean, & Marlatt, 1998; Jessor, Donovan, & Costa, 1991), so more homogenous samples may provide clearer data regarding rates of substance use during these periods. The transition to emerging adulthood is particularly important, as substance use begins to peak and many survivors are changing from pediatric to adult care providers.

Although early predictors of externalizing behaviors and substance use have been identified in the general population, few studies have included survivors of childhood cancer. Childhood aggression predicts subsequent externalizing behaviors, antisocial acts, and substance use/abuse throughout adolescence and young adulthood (Rubin, Chen, McDougall, Bowker, & McKinnon, 1995). Furthermore, difficulties with acceptance, as well as affiliation with deviant peers, have predicted early onset of alcohol and drug use (Boyle et al., 1992; Dishion & Owen, 2002; Patterson, Dishion, & Yoerger, 2000). Insomuch as children with cancer are accepted by peers and protected from externalizing behavior during cancer treatment (Noll et al., 1999), survivors may be less likely to engage in externalizing behaviors and substance use during adolescence and emerging adulthood. Thus, peer acceptance and less aggressive behavior in childhood may explain the association between cancer status and later externalizing behavior and substance use.

Limited research has examined the role of medical variables in the prediction of externalizing behaviors and substance use in survivors. In one study, time since diagnosis and length of treatment were unrelated to substance use (Bauld, Toumbourou, Anderson, Coffey, & Olsson, 2005). Findings regarding the influence of type and severity of treatment have been inconsistent, with one study reporting lower rates of smoking among those either receiving radiation to the brain or pulmonary toxic drugs (Emmons et al., 2002) and another finding no direct effect of treatment intensity and substance use (Chen et al., 1998). Multiple studies, however, have noted a positive association between age of diagnosis and substance use (Emmons et al., 2002; Tercyak, Donze, Prahlad, Mosher, & Shad, 2006; Tyc et al., 2001). To date, severity of late effects has not been examined but may be an important factor.

Given the relative lack of data on externalizing behavior and substance use among survivors, as well as early predictors of these behaviors, we used standardized measures and multiple informants to examine differences in externalizing behavior and substance use among survivors of childhood cancer and comparison peers during the transition to emerging adulthood. The role of earlier peer acceptance and social behavior (i.e., measured during cancer treatment) was examined, and medical predictors were identified. We expected that: (a) survivors would engage in fewer externalizing behaviors and substance use than peers; (b) earlier peer acceptance and less aggressive social behavior would mediate the association between group status and later externalizing behaviors and substance use; and (c) among survivors, younger age at diagnosis would be associated with fewer externalizing behaviors and substance use. The roles of severity of treatment and late effects were also explored.

Method

General Overview

This work was a longitudinal expansion of a study on the adjustment of families of children with cancer and comparison peers (for initial procedures, see Noll et al., 1999; Verrill, Schafer, Vannatta, & Noll, 2000). It involved three phases, each requiring separate consent forms: (a) a classroom study where data on peer relationships were obtained and potential comparison peers were identified; (b) visits to the homes of participating children with cancer and comparison peers during the summer following the classroom assessment; and (c) a follow-up home visit shortly after the child turned 18. All procedures were approved by the Institutional Review Board, and families were compensated for their time.

Participants: Initial School and Home Visits

Children with cancer were initially identified from the cancer registry at a large children's hospital. Eligible children were: (a) 8- to15-years old, (b) on treatment for cancer not primarily involving the central nervous system, (c) in school without full-time special education, (d) living within 50 miles of the hospital, and (e) English speaking. At recruitment, average time from diagnosis was 11.2 months ($SD = 7.8$). Parents provided permission to contact the child's principal about the study. Sociometric assessments were completed in each child's primary class (elementary) or a required academic class (middle/high school) during cancer treatment. Teachers distributed consent forms to students for parents to sign and return; 93% of classmates participated. To minimize stigma for the child with cancer, the study was described to peers as a project about friendships without mention of cancer, the hospital, or any particular student. One hundred families participated in the school assessment, and 95 (95%) participated in an initial home assessment.

For the comparison sample, one peer was identified from each classroom roster who was of the same race and gender and nearest in age to the child with cancer (Noll et al., 1999). After the classroom assessment, the family of the first potential comparison peer was contacted and invited to participate in the home assessment. If they declined, the next closest peer was recruited. All comparison families were screened to ensure the absence of a pediatric chronic illness in the family. Of the 100 eligible comparison peers, 98 (98%) participated in the first home visit.

Participants: Follow-up Assessment

All children who participated in the initial home visit and had reached their 18th birthday were eligible for the follow-up assessment. Of 62 available survivors,[1] 56 (90%) participated [i.e., five refused, one not contacted (e.g., moved, not located)]. Survivors were on average 18.63 years old ($SD = 0.75$, range = 17.67–21.00). The sample was 66% ($n = 37$) male and 93% ($n = 52$) Caucasian. Mean age at diagnosis was 11.32 ($SD = 2.60$), and time since diagnosis was 7.32 years ($SD = 2.27$). Diagnoses of the follow-up sample included 38% ($n = 21$) leukemias, 39% ($n = 22$) lymphomas, and 23% ($n = 13$) solid tumors. Data were collected from 52 mothers and 31 fathers; two families had a single father, 12 had a single mother, and 5 fathers declined.

Seventy-seven comparison peers were eligible for follow-up, and 60 (78%) participated [five refused; 12 not contacted (e.g., moved, not located)]. Comparison peers were on average 18.62 years old ($SD = 0.71$, range = 18.00–20.92). The sample was 63.3% ($n = 38$) male and 93.3% ($n = 56$) Caucasian. Data were collected from 59 mothers and 45 fathers; one family had a single father, 10 had a single mother, and 2 fathers declined.

Average time between initial and follow-up assessments was 5.93 years ($SD = 2.10$, range = 2.00–10.42) and did not differ between groups, $t(112) = -.70$, $p =$ ns.

Attrition

Those who participated in the longitudinal follow-up were similar to those who dropped out on all initial demographic, peer, and adjustment variables, except participants in the follow-up were significantly higher on initial mother report of externalizing behavior, $t(186) = 2.18$, $p < .05$. Among survivors, longitudinal participants did not differ from drop outs on severity of initial treatment, but they were older at diagnosis, $t(85) = 3.82$, $p < .01$.

Measures: Initial School Assessment

Peer Acceptance Ratings

Students completed 5-point ratings of how much they liked each classmate (Asher, Singleton, Tinsley, & Hymel, 1979). Mean acceptance ratings were computed and are considered a reliable index of a child's relative social acceptance (Asher et al., 1979).

Best Friend Nominations

Students identified three best friends from a list of classmates. This yielded a social preference score for the number of nominations received and a mutual friendship

[1]Participants who had turned 18-years old through 2003 were included. After 2003, further data collection was discontinued due to relocation of primary study investigators to new institutions.

score for the number of reciprocated friendships. This provides a stable and valid index of peer acceptance (Bukowski & Hoza, 1989).

Revised Class Play

The Revised Class Play (RCP; Masten, Morison, & Pellegrini, 1985) uses a descriptive matching technique to assess social behavior among classmates. Students were asked to imagine they were the director of a play and to ''cast'' classmates into 39 hypothetical ''roles.'' Nominations were limited to students of the same gender as the target child to avoid gender-role stereotyping. Nominations were tallied for each role and summed to create four behavioral subscales that demonstrate adequate internal consistency (α's range from .81 to .95): (a) Leadership–Popularity, (b) Prosocial, (c) Aggressive–Disruptive, and (d) Sensitive–Isolated (Zeller, Vannatta, Schafer, & Noll, 2003). Aggressive–Disruptive and Sensitive–Isolated scores are also predictive of later psychopathology and behavior problems (Hymel, Rubin, Rowden, & LeMare, 1990; Morison & Masten, 1991; Rubin, 1993). Stability has been demonstrated by correlations across a 17-month interval that range from .63 to .65 (Masten, et al. 1985).

Measures: Initial Home Assessment

Demographic Questionnaire

This parent-report measure assesses characteristics of the respondent (e.g., marital status, education, occupation). Socioeconomic status (SES) was computed using the Revised Duncan (Nakao & Treas, 1992).

Child Behavior Checklist

The Child Behavior Checklist (CBCL; Achenbach, 1991) is a parent-report measure that assesses emotional and behavioral problems, as well as social competence, for children ages 4–18. The CBCL consists of 113 items scored on a three-point scale based on frequency in the preceding 6 months. It exhibits good reliability and validity (Achenbach, 1991). Broad-band externalizing scores were used for this study.

Treatment Severity

Two pediatric oncologists rated each child's initial treatment protocol from least (1) to most (10) severe using a forced choice technique (Noll et al., 1999) with strong inter-rater agreement ($r = .82$). This measure has been associated with teacher and peer reports of social functioning for children on treatment for cancer (Noll et al., 1999). Average treatment severity was 5.61 ($SD = 2.54$) for this sample.

Measures: Follow-up Assessment

Parents again completed the demographic questionnaire and the CBCL[2] as described above.

Antisocial Behavior Checklist (ASB)

Young adults completed this 46-item questionnaire to assess frequency of participation in numerous aggressive and antisocial acts. Internal consistency for this sample was .91. Test–retest reliability over four weeks ($r = .91$) has been shown (Noll, Zucker, Fitzgerald, & Curtis, 1992), and this scale differentiates among groups with varying degrees of antisocial behavior (Zucker & Noll, 1980).

Drinking and Drug History

Young adults noted if they had used alcohol, tobacco, marijuana, and 10 other illegal drugs. For alcohol, age of initiation, frequency of use (days/month), quantity (drinks/24 hr period), and frequency of drunken episodes in the last 6 months were assessed. Frequency of tobacco use was rated from 1 (not at all) to 7 (>2 packs/day). For marijuana and other drugs, frequency for lifetime, past year, and past month use was rated from 1 (0 times) to 7 ($\geq$40 times).Validity has been noted (Noll, Zucker, et al., 1992).

Late Effects

Severity of late effects near follow-up was rated by the pediatric nurse practitioner in long term survivor clinic. Similar to previous work (Mulhern, Wasserman, Friedman, & Fairclough, 1989), late effects in four categories (i.e., cosmetic impairment, functional impairment, learning problems, and other organ toxicities) were rated from 0 to 3 as absent, mild, moderate, or severe. A total score was summed for 49 survivors. Data were unavailable for seven survivors because they did not receive medical follow-up at the long-term clinic and were unknown to the nurse practitioner. The average score for this sample was 1.00 ($SD = 1.04$), with 59% ($n = 29$) having at least one late effect.

Data Analytic Plan

Item and scale scores for the RCP and peer acceptance ratings were standardized ($M = 0$, $SD = 1$) to adjust for

[2]The CBCL is appropriate for children and young adults up to age 19, particularly when youth are living at home (over 90% of the current sample) and when earlier measures of the CBCL were administered to aid longitudinal comparisons (as is the case with this work). In addition, upward extensions of the CBCL (i.e., the Adult Behavior Checklist) were not yet developed for use with older youth at the start of the study.

class size, composition, and participation rates. Independent *t*-tests ($\alpha = .05$, two-tailed) compared survivors and peers on initial background and peer relationship variables, and attrition analyses were conducted. Chi-squared analyses, Mann–Whitney U-, and *t*-tests ($\alpha = .05$, two-tailed) evaluated group differences in externalizing behavior, and effect sizes (Cohen's *d*) were reported. Pearson correlations ($\alpha = .05$, two-tailed) between predictors and outcomes informed hierarchical and logistic regressions testing mediation and moderation. The sample of 111 mothers and 116 young adults produced power (.76–.90) to detect medium effects for *t*-tests ($d = .5$), chi-squares ($w = .3$), and correlations ($r = .3$). The sample of 76 fathers provided power (.74–.77) to detect medium effects for chi-squares and correlations but only large effects ($d = .8$) for *t*-tests (.92). For correlations among survivors, power was .64 and .99 for medium ($r = .3$) and large ($r = .5$) effects, respectively.

Table I. Comparison of Demographic Characteristics for Families of Survivors ($n = 56$) and Peers ($n = 60$)

	Survivors *M (SD)*	Peers *M (SD)*	t(114)[a]	d[b]
Youth age initially (years)	12.91 (2.45)	12.60 (2.38)	0.67	.13
Youth age at follow-up (years)	18.63 (.75)	18.62 (0.71)	0.03	.01
Father age at follow-up (years)	47.76 (4.07)	47.70 (4.51)	0.29	.01
Mother age at follow-up (years)	44.91 (5.41)	45.16 (4.29)	0.37	.05
SES	46.51 (19.8)	51.82 (20.15)	−1.43	.27
Father education	13.74 (2.72)	14.28 (2.97)	−0.84	.19
Mother education	13.02 (2.27)	13.61 (2.58)	−1.27	.24
Number of children in home	2.10 (1.14)	2.334 (1.59)	−0.90	.17

Note. SES based upon Duncan Total Socioeconomic Index for head of household.
[a]Degrees of freedom range from 81 to 114 because of missing information from participants. All values are nonsignificant.
[b]Cohen's *d* effect size, small = .20, medium = .50, large = .80.

Results

Demographic, Peer Relationship, and Externalizing Variables at Initial Assessment

Initial between group differences in predictor variables have been reported previously among a larger sample (Noll et al., 1999) and are noted for the current follow-up subsample of survivors for descriptive purposes. Survivors and comparison peers did not differ on a variety of background variables (Table I). Mothers of survivors were equally likely to be married (78%) as mothers of peers (83%), $\chi^2(1, 114) = .56$, $p = \text{ns}$. There were no significant differences in initial peer acceptance variables (Table II). Leadership–Popularity, Aggressive–Disruptive, and Sensitive–Isolated scores were similar between groups, but survivors were perceived as more prosocial than peers. Groups also differed on initial mother report of externalizing behavior.

Externalizing Behavior and Substance Use at Follow-up

Between group differences in outcome variables have been reported among a subsample of survivors (Verrill et al., 2000), but are reported here for the full follow-up sample. We expected survivors would engage in less externalizing behavior and substance use than peers. No differences were found for mother and father reports of externalizing behavior or self report of antisocial behavior at follow-up (Table II). According to both mothers and fathers, six survivors (11%) exceeded the clinical cutoff on the CBCL (*T*-score ≥ 60) compared to four peers (6%), $\chi^2(1, 112) = .46$, $p = \text{ns}$.

Table II. Comparison of Peer Acceptance, Social Behavior, and Externalizing Behavior for Survivors ($n = 56$) and Peers ($n = 60$)

	Survivors *M (SD)*	Peers *M (SD)*	t(114)[a]	d
Initial assessment				
Acceptance ratings	.36 (.93)	.06 (.88)	1.74	.33
Best friend nominations	−.06 (.89)	.19 (.94)	−1.44	.27
Reciprocated nominations	−.15 (.92)	.20 (1.04)	−1.90	.36
RCP Leadership–Popularity	.03 (.87)	.11 (1.01)	−0.45	.08
RCP Prosocial	.53 (1.15)	.11 (.96)	2.07*	.39
RCP Aggressive–Disruptive	−.35 (.69)	−.11 (.94)	−1.53	.29
RCP Sensitive–Isolated	.13 (.97)	.04 (.94)	0.51	.10
Ext behavior (mother report)	54.94 (10.17)	51.47 (8.87)	2.17*	.41
Ext behavior (father report)	52.08 (8.62)	51.06 (8.44)	0.59	.13
Follow-up assessment				
Ext behavior (mother report)	45.91 (11.88)	46.36 (8.83)	0.54	.10
Ext behavior (father report)	48.94 (10.93)	45.67 (9.68)	1.28	.30
ASB (youth report)	55.89 (9.07)	56.98 (11.33)	−0.56	.10

Note. Ext behavior, Externalizing behavior on the CBCL; RCP, Revised Class Play; ASB, Antisocial Behavior Checklist.
[a]Degrees of freedom range from 74 to 114 because of missing information from fathers.
*$p < .05$, two-tailed.

Chi-squared analyses indicated that survivors were just as likely as peers to have tried alcohol (74% survivors, 85% peers), $\chi^2(1, 116) = 2.15$, $p = \text{ns}$; tobacco (63% survivors, 64% peers), $\chi^2(1, 116) = 0.05$, $p = \text{ns}$; or other drugs (27% survivors, 24% peers), $\chi^2(1, 116) = 0.14$, $p = \text{ns}$. However, peers were twice as likely to have tried marijuana (34% survivors, 53% peers), $\chi^2(1, 116) = 4.05$, $p < .05$, odds ratio (OR) = 2.16. Among survivors ($n = 43$)

and peers ($n = 52$) who had used alcohol, there were no differences in age of initiation ($M_{survivors} = 14.67$, $SD = 1.95$; $M_{peers} = 15.04$, $SD = 2.04$), $t(95) = -0.88$, $p =$ ns; frequency of drinking in the past 6 months ($M_{survivors} = 4.14$, $SD = 5.37$; $M_{peers} = 3.17$, $SD = 4.50$), $t(95) = 0.95$, $p =$ ns; or quantity of use ($M_{survivors} = 5.33$, $SD = 4.45$; $M_{peers} = 3.61$, $SD = 4.60$), $t(95) = 1.83$, $p =$ ns. However, a modest effect size ($d = .37$) suggested survivors may drink more at each episode than peers. Both groups had a similar number of drunken episodes, U = 1,540, $p =$ ns, with a median score of 1–2 times in the last six months. Among those who had tried tobacco ($n = 35$ survivors, $n = 38$ peers), age of initiation, $t(71) = -0.53$, $p =$ ns, was similar between groups (i.e., age 14). Both groups reported similar amounts of smoking, U = 993, $p =$ ns, with a median of one cigarette/day in the last month.

Among those who tried marijuana ($n = 19$ survivors, $n = 31$ peers), there were no group differences in frequency of use for lifetime, U = 1,453, $p =$ ns; past year, U = 1,303, $p =$ ns; or past month, U = 1,501, $p =$ ns. Both groups had medians of 6–19 times for lifetime use, 3–6 times for the past year, and 0–1 times for the past month. Of those who tried other substances ($n = 15$ survivors, $n = 14$ peers), both groups reported using an average of three drugs other than marijuana. Survivors and peers reported similar frequencies of drug use for their lifetime, U = 1,617, $p =$ ns; past year, U = 1,571, $p =$ ns; and past month, U = 1,553, $p =$ ns, with medians of 20–39 times for lifetime use, 3–9 times for the past year, and 0–2 times for the past month.

Associations Between Initial and Follow-up Variables

Correlations between initial and follow-up variables are presented in Table III. We expected that earlier peer acceptance and less aggressive social behavior would mediate the association between group status and later externalizing behavior and substance use. Time between assessments was not significantly correlated with any initial or follow-up variables. At follow-up, alcohol use was associated with lower scores for sensitive–isolated behavior, $r(113) = -.20$, $p = .05$, in childhood. Tobacco use was associated with being less prosocial, $r(113) = -.19$, $p = .05$, and more aggressive–disruptive, $r(113) = .19$, $p = .05$, while marijuana use was associated with total number of best friends, $r(113) = .26$, $p = .01$, and being less prosocial, $r(113) = -.20$, $p = .05$, and less sensitive–isolated, $r(113) = -.36$, $p = .01$. The use of other drugs was associated with greater peer acceptance, $r(113) = .20$, $p = .05$, higher leadership–popularity scores, $r(113) = .20$, $p = .05$, and lower sensitive-isolated scores, $r(113) = -.22$, $p = .05$. Hierarchical logistic regressions were not conducted because the peer relationship variables associated with substance use outcomes were highly intercorrelated and accounting for overlapping variance in regression models. Contrary to our expectations, assumptions for mediation were not met for the role of early peer variables

Table III. Pearson Correlations among Peer Acceptance, Social Behavior, and Externalizing Behavior during Cancer Treatment and Later Externalizing Behavior and Substance Use

	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Acceptance ratings	.56**	.43**	.60**	.59**	−.42**	−.43**	−.21*	−.20	−.13	−.20	.05	−.08	−.06	.12	.20*
2. Total best friends	–	.78**	.71**	.22*	−.02	−.53**	−.14	−.15	−.04	.02	.03	.12	.13	.26**	.16
3. Reciprocated friendships		–	.50**	.17	.03	−.42**	−.05	−.22*	.07	.03	−.01	.02	.09	.17	.06
4. Leadership–Popularity			–	.31**	−.03	−.55**	−.27**	−.18	−.18	−.11	−.01	.16	.01	−.20*	−.12
5. Prosocial				–	−.52**	.08	−.14	−.18	−.18	−.19	−.12	−.02	−.19*	−.20*	−.12
6. Aggressive–Disruptive					–	−.01	.13	.20	.11	.11	.14	.10	.19*	.15	.16
7. Sensitive–Isolated						–	.29**	.32**	.09	.22	−.16	−.20*	−.08	−.36**	−.22*
8. Ext beh- mom T1							–	.45**	.63**	.53**	.04	−.17	.03	−.09	−.06
9. Ext beh- dad T1								–	.25*	.62**	.04	−.16	.11	−.07	.06
10. Ext beh- mom T2									–	.67**	.23*	.00	.11	.09	−.06
11. Ext beh- dad T2										–	.13	−.17	.11	−.07	−.08
12. ASB											–	.32**	.34**	.47**	.41**
13. Ever used alcohol												–	.34**	.37**	.17
14. Ever used tobacco													–	.48**	.32**
15. Ever used marijuana														–	.38**
16. Ever used other drugs															–

Note. SES based upon Duncan Total Socioeconomic Index for head of household. Ext Beh, Externalizing behavior; T1, initial assessment; T2, follow-up assessment.
*$p < .05$; **$p < .01$

in the association between group status and later externalizing behavior (Baron & Kenny, 1986), as there were no group differences in later externalizing behavior (i.e., the direct effect).

Within-group Effects of Illness and Treatment Variables

As predicted, age at diagnosis among survivors was positively associated with self-report of antisocial behavior, $r(52) = .37$, $p < .01$; marijuana use, $r(55) = .27$, $p < .05$; and other drug use, $r(55) = .28$, $p < .05$. Severity of initial treatment, severity of late effects, and time since diagnosis were unrelated to externalizing behavior and substance use at follow-up.

Discussion

Using a longitudinal design, we examined the role of peer acceptance, social behavior, and medical factors in predicting later externalizing behaviors and substance use among survivors of childhood cancer and comparison peers. Participants represented a relatively homogenous age group (i.e., 18–20) during the transition from adolescence to emerging adulthood. This is a critical period for externalizing behaviors and substance use (Baer et al., 1998; Jessor et al., 1991), as well as for healthcare transitions among survivors. We found no differences between survivors and peers on self- and parent report of externalizing behaviors. Survivors were less likely to have tried marijuana, but they used alcohol, tobacco, and other drugs at rates similar to peers. Some earlier social behavior factors were associated with later substance use for all participants. Furthermore, survivors who were older at diagnosis had a greater risk for externalizing behavior and substance use.

Survivors demonstrated patterns of externalizing behavior comparable to comparison peers. Although this is contrary to our predictions and previous findings (Noll et al., 1999), it is consistent with other work (Kazak, Christakis, Alderfer, & Coiro, 1994; Sawyer, Antoniou, Toogood, Rice, & Baghurst, 2000). Rates of substance use were also similar between groups and largely consistent with epidemiological data (CDC, 2008; Johnston et al., 1999), except survivors were less likely to have tried marijuana. Interestingly, survivors' rates of marijuana use were comparable to national averages, whereas peers' rates were notably higher (CDC, 2008). Overall, findings support the resilience of survivors of childhood cancer and are consistent with other research including a variety of psychosocial outcomes and informants (Marsland, Ewing, & Thompson, 2006). In some respects, it is encouraging that survivors are behaving like 'normal' teenagers, as noted by others (Haupt et al., 1992; Hollen & Hobbie, 1996; Mulhern et al., 1995). However, even developmentally typical experimentation is concerning, as survivors are at higher risk for health problems in adulthood. Furthermore, effect sizes suggested that once survivors had initiated substance use, they may have used more frequently and in larger quantities than peers. Future research examining substance use, perhaps by means other than retrospective report, is needed to replicate findings.

Although peer acceptance and social behavior have been related to future externalizing behavior and substance use in other studies (Dishion & Owen, 2002; Patterson et al., 2000; Rubin et al., 1995), they did not predict later externalizing behavior in the present sample. Previous work has indicated small to moderate sized effects between aggressive-disruptive, prosocial, and leadership domains and later externalizing behavior (Gest, Sesma, Masten, & Tellegen, 2006; Realmuto, August, & Hektner, 2000). Our data indicated negligible to small associations ($r = -.01$ to $-.19$), which may be due to differences in informants across studies (i.e., individual report vs. composite scores). As expected, mother and father reports of earlier externalizing behavior showed significant stability into emerging adulthood ($r = .25$–$.63$), which is consistent with previous work (Gest et al., 2006); however, they were unrelated to participant self-report of later antisocial behavior ($r = .04$).

A behavioral reputation as sensitive–isolated during cancer treatment was most consistently and negatively associated with later substance use. Although this domain is often a robust predictor of later internalizing problems (Hymel et al., 1990), a negative association with externalizing problems has also been noted (Realmuto et al., 2000) particularly among children who are passive-isolated (i.e., withdrawn) rather than rejected–isolated (i.e., rebuffed; Hoza, Molina, Bukowski, & Sippola, 1995). The role of popularity in substance use experimentation has also been documented (Allen, Porter, McFarland, Marsh, & McElhaney, 2005), as integration into larger peer networks increases opportunity and perhaps pressure to use. This likely explains our findings regarding sensitive–isolated behavior, as well as why indices of peer acceptance were positively associated with use of marijuana and other substances. Lastly, limited work has examined associations with the prosocial scale as it is a relatively new factor (Zeller et al., 2003) previously embedded with leadership–popularity. We found prosocial behavior was inversely related to tobacco and

marijuana use, which is consistent with recent work (Gest et al., 2006).

Among survivors, older age of diagnosis was consistently associated with higher rates of externalizing behavior and substance use, which is similar to previous work (Emmons et al., 2002; Tercyak et al., 2006; Tyc et al., 2001). Individuals who were diagnosed later may have already begun experimenting with high risk behaviors or had initiated substance use. Coping with a chronic illness during adolescence also may encourage survivors to engage in behaviors that promote feelings of normalcy and acceptance (i.e., substance use experimentation). Conversely, being diagnosed at a younger age may afford fewer opportunities for experimentation due to treatment side effects, hospitalizations, and parental monitoring. Thus, survivors diagnosed at a younger age may be diverted off the typical developmental trajectory, and initiation of these behaviors may be delayed. Initial treatment intensity and severity of late effects were not related to later use. Although other work has found associations between treatment severity and later substance use, this has not been consistent (Chen et al., 1998; Emmons et al., 2002). It is also possible we did not find associations with severity of late effects because many of our survivors had only mild evidence of problems.

Although this study adds to the literature by providing a controlled, prospective examination of factors predicting externalizing behavior and substance use during a critical developmental period, findings are limited by a small sample of survivors with non-CNS tumors that is relatively homogenous in terms of racial and ethnic diversity. Effect sizes suggest small group differences between survivors and peers, but power was limited. In addition, retrospective self-report of substance use may be less accurate than prospective methods of assessment, and our measure of severity of late effects, though based on previous work, has not been validated or standardized.

Continued study of health outcomes related to health-risk behavior among survivors is needed. Future research should include more detailed assessment of substance use and measures of externalizing behavior that are comparable across multiple informants (i.e., CBCL and Youth Self-Report). To develop empirically-supported interventions, additional research is needed that explores potential mediators of substance use (e.g., perceived health risk, parental monitoring, deviant peer affiliations) within this population. Finally, longitudinal research that includes multiple sites is needed to increase sample diversity and to identify trajectories that distinguish between developmentally limited experimentation during a period of elevated risk and chronic, frequent use that requires more intensive intervention.

Clinically, routine assessment of substance use among survivors is important, particularly during the transition from late adolescence to emerging adulthood when base rates are relatively high compared to other ages. Education should be a primary focus in care settings, as patients transitioning off of active treatment need to be knowledgeable about their diagnosis, treatment, late effects, and the risks of health-compromising behaviors. Although education is necessary, it may not be sufficient. Research on processes involved in survivors' decisions to use substances will provide better insight regarding how best to intervene and who to include in interventions (e.g., peers, family). Motivational interviewing, an empirically-validated intervention for substance use (Noonan & Moyers, 1997), may help survivors, particularly those who were older at diagnosis or who have already initiated use.

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