Aggression, Antisocial Behavior, and Substance Abuse in Survivors of Pediatric Cancer: Possible Protective Effects of Cancer and Its Treatment

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Objective: To examine aggression, antisocial behavior, and substance abuse in young adult survivors of pediatric cancer (PCS) relative to case control peers (CC).

Methods: We obtained self-reports of current aggression, antisocial behavior, and lifetime substance use from 26 PCS (time off-treatment, \( M = 56 \) months) and 26 CC using the Antisocial Behavior Checklist and the Drinking and Drug History. A report of current aggression and antisocial behavior also was obtained from primary caregivers using the Child Behavior Checklist.

Results: PCS self-reported significantly less illegal drug use and experimentation than CC. No significant differences emerged between groups for use of alcohol and tobacco nor for aggression and antisocial behavior.

Conclusions: PCS are functioning as well as, or better than, CC in terms of aggression, antisocial behavior, and substance abuse. However, given the compromised health status of survivors, efforts should focus on further reduction of drug-related risk behaviors that may amplify organ damage or increase risk for further malignancies in this population.

Key words: pediatric cancer; survivors; adolescents; young adults; substance use; aggression; antisocial behavior.

Advances in pediatric cancer treatment over the past two decades have resulted in a dramatic increase in long-term survival rates of children diagnosed with cancer. It is estimated that 1 in every 900 young adults will be a survivor of childhood cancer by the year 2000 (Bleyer, 1990). Increasingly intense courses of treatment, including chemotherapy, radiation, and surgery, are responsible for the improved prognosis. However, the combination of decreased mortality and increased treatment intensity has raised concerns about psychosocial quality of life for survivors. Psychosocial quality of life can be defined as the individual’s functioning within the broad domain of mental health, including emotional well-being, behavioral adaptation, presence or absence of psychiatric symptoms, intellectual functioning, and social competence.

No studies report significant psychiatric problems in survivors of pediatric cancer (see review by Kazak, 1994). However, conclusions regarding more subtle or circumscribed psychosocial difficulties are less clear. Social or emotional difficulties have been identified by some studies (e.g., Mulhern, Wasser-
man, Friedman, & Fairclough, 1989), whereas others have identified few of these problems for children surviving cancer (e.g., Kazak, Christakis, Alderfer, & Coiro, 1994). Of note, studies that report difficulties have consistently described internalizing problems such as anxiety, depression, somatic complaints, or social withdrawal (e.g., Zeltzer et al., 1997). Children treated with cranial irradiation also may demonstrate more difficulties related to inattention, concentration, or short-term memory (e.g., Lockwood, Bell, & Colegrove, 1999). However, studies suggesting problems with physically aggressive behavior are conspicuously absent from the literature. This void is logical because children with cancer experience side effects that may interfere with the development of these externalizing behaviors.

Persistent fatigue (Granowetter, 1994) and growth problems (Kirk et al., 1987) are two side effects of treatment that may limit a child’s ability to engage in physically aggressive behaviors. Specifically, general malaise and diminished stature may leave a child feeling more physically vulnerable and result in avoidance of aggressive peer groups and situations. Additionally, lengthy hospital stays and frequent outpatient appointments take considerable time and may limit a child’s opportunities for unsupervised time with peers. Increased parental involvement is another result of the pediatric cancer experience (Rait et al., 1992) that may decrease a child’s opportunities to engage with peers in aggressive or delinquent activities (Dishion, Capaldi, Spracklen, & Li, 1995). This limitation in unsupervised time with peers may be particularly important for children diagnosed during early adolescence, as this is the peak time for initiation into early forms of substance use (Tyc, Hudson, Hinds, Elliott, & Kibby, 1997).

The association of school-age aggression and involvement in deviant peer groups with later aggression, antisocial behavior, and substance abuse in adolescence and young adulthood has been well documented. There is substantial agreement that aggression is a highly stable behavioral characteristic (Rubin, Chen, McDougall, Bowker, & McKinnon, 1995). Childhood aggression predicts subsequent externalizing behaviors, antisocial activities, and drug use/abuse through adolescence and adulthood (Dobkin, Tremblay, Masse, & Vitaro, 1995). Both early aggressive behavior and difficulties with peer acceptance predict early onset of alcohol and drug use (Boyle et al., 1992). Early onset of substance use has been associated with greater severity of abuse in adolescents and young adults (Mezzich et al., 1993; Newcomb & Bentler, 1990).

For children who survive cancer treatment, this constellation of risk behaviors may carry additional, serious consequences. Long-term pediatric cancer survivors have been found to have an increased incidence of second malignancies (Meadows &enton, 1994), as well as increased risk for adverse health outcomes due to organ damage and other late physical effects of treatment (DeLaat & Lamkin, 1992). Involvement with deviant peer groups and substance abuse could amplify organ damage or increase risk for further malignancies. This has been an increasing concern for health care professionals working with this population (Hollen, Hobbie, & Finley, 1997). It is especially important to evaluate the involvement of survivors in these risk behaviors.

The physical and social side effects of pediatric cancer treatment ultimately may serve a protective role with regard to the development of early risk behaviors by limiting behavioral options. A recent study found that school-age children with cancer were viewed as less aggressive and disruptive than classmates by both teachers and peers (Noll, Gartstein, Vannatta, Bukowski, & Davies, 1999). Additionally, sociometric ratings of acceptance indicate that school-age children with cancer actually may enjoy a higher level of popularity than classroom comparison peers, despite the imposed behavioral limitations (Noll et al., 1999). Given the continuity of externalizing behavior, if pediatric cancer treatment limits involvement in early externalizing behavior, as suggested by Noll and colleagues (1999), children diagnosed with cancer during early adolescence may be at decreased risk for serious problems with aggression, antisocial behavior, and substance use in young adulthood.

The aim of this study was to explore a constellation of risk behaviors in a population of young adult survivors of pediatric cancer diagnosed during early adolescence. Regional and generational variability of drug use necessitated use of an appropriate comparison group. Pediatric cancer survivors who had reached age 18 were compared to same-age peers. Both groups had been identified during the cancer survivor’s initial treatment and were followed prospectively since diagnosis. We hypothesized that (1) young adults who were cancer survivors would be rated as engaging in fewer ag-
gressive and antisocial behaviors than peers; and, (2) young adults who were cancer survivors would report less substance abuse than peers.

**Method**

This research was reviewed and approved by the Institutional Review Board of Children’s Hospital Medical Center.

**Participants**

*Pediatric Cancer Survivors (PCS).* Participants in this research were part of a longitudinal study of children with chronic illness conducted at a children’s medical center. Children were eligible for participation in the first phase of data collection if they were: (1) 12–15 years of age at time of diagnosis; (2) receiving treatment for a malignancy that did not primarily involve the central nervous system (CNS); (3) attending school at the time of recruitment; and, (4) not enrolled in full-time special education. Because this medical center is the only pediatric inpatient facility in the region and has the only board-certified pediatric oncologists, it serves nearly every child diagnosed with cancer in the area. This fact, in combination with recruitment above 97%, suggests that the original sample consisted of nearly every child aged 12 to 15 in this area who was diagnosed with pediatric cancer during the study period (Noll et al., 1999).

Participants from the initial cohort (Noll et al., 1999), were eligible for participation in this follow-up study if they were (1) approximately 18 years of age, and, (2) off-treatment and in remission at the time of data collection. Of the 29 participants from the initial cohort who met the age requirement, two were excluded because of relapse and ongoing treatment. In addition, one individual declined to participate, thus yielding a final sample of 26 survivors (16 males, 10 females) and their primary caregivers. This sample included survivors of leukemias (*n* = 9), lymphomas (*n* = 12), and various solid tumors (*n* = 5). All survivors received chemotherapy during treatment and seven participants also received 1800 cGy whole brain radiation therapy (WBRT) during the induction phase of treatment. All survivors had been off-treatment for at least one year (*M* = 4 years 8 months, *SD* = 1 year 8 months) at the time of data collection and were in first continuous remission.

**Case Controls.** Case controls (CC) were obtained using a case-by-case matching procedure. During the initial treatment phase for each child with cancer, case controls were identified who were classmates of the same age and race and who had the closest date of birth to the target child. If the child with the closest date of birth declined to participate, the child with the next closest date of birth was asked. The recruitment rate for first-choice case controls was 87%. At follow-up, two of these individuals declined to participate and one participant could not be located, yielding a final sample of 26 case controls (16 males, 10 females) and their primary caregivers. All participants in this study had been originally classified as White by simple observation at the time of initial recruitment.

**Procedure**

As each participant’s eighteenth birthday approached, that individual’s family was contacted to participate in data collection. Following written consent, questionnaires were administered individually to all participants by a trained member of the research team. Each family received monetary compensation for participating.

**Measures**

**Demographic Questionnaire.** This instrument (Noll et al., 1999) assessed background information from the primary caregiver, including occupational information needed to determine the socioeconomic status (SES) of each family using the Revised Duncan (Nakao & Treas, 1992). We chose the Revised Duncan because occupation-based measures represent a more contemporary indicator of SES than traditional income-based measures (Hauser, 1994).

**Wechsler Adult Intelligence Scale-Revised (WAIS-R).** Scores from the Vocabulary and Block Design subtests of the WAIS-R (Wechsler, 1981) were used to compute an estimated Full Scale Intelligence Quotient. Correlations with Full Scale IQ have been reported at .90 and reliability has been reported at .94 across nine age groups for this brief composite (Sattler, 1992).

**Child Behavior Checklist (CBCL).** The CBCL (Achenbach, 1991) is a parent-report instrument that measures a child’s behavioral and emotional problems on a 3-point Likert scale ranging from “never true” to “always true.” CBCL items that ex-
hibited face validity in terms of aggression and antisocial behavior were selected for possible inclusion in an index scale of aggressive and antisocial behavior. All items from the delinquent behavior scale were included, with the exception of one item, “Uses alcohol or drugs for nonmedical purposes.” This item was excluded to decrease overlap between the two hypotheses of the study. Ten items from the aggressive behavior scale also were included. Finally, one additional item, “Cruel to animals,” which was not included on either the delinquent or aggressive behavior scales, was included in the pool of aggressive and antisocial items. The final pool of items was used in the construction of an index scale of aggressive and antisocial behavior designed to combine information from both primary caregiver and young adult.

**Antisocial Behavior Checklist (ASB).** The ASB (Zucker & Noll, 1980) is a 46-item self-report questionnaire designed to assess the frequency of a respondent’s involvement in aggressive and antisocial activities on a 4-point Likert-type scale from “never” to “often.” The ASB was adapted from an earlier antisocial behavior inventory (Zucker & Barron, 1973). This instrument demonstrates adequate test-retest reliability \( r = .91 \) over 4 weeks and internal reliability of \( \alpha = .93 \) (Noll, Zucker, Fitzgerald, & Noll, 1992). The ASB has been shown to discriminate between individuals engaging in antisocial behavior and case controls (Noll et al., 1992). All items included on the ASB were used in the construction of an index scale of aggressive and antisocial behavior designed to combine information from both primary caregiver and young adult.

**Drinking and Drug History (DDH).** The DDH (Zucker, Fitzgerald, & Noll, 1990) is a self-report questionnaire developed to obtain information about past and current drug consumption and common problems resulting from excessive substance use. Literature indicates that self-report of substance use is most accurate when adolescents are given sufficient assurance of confidentiality (e.g., Rouse, Kozel, & Richards, 1985; Williams, Eng, Botvin, Hill, & Wynder, 1979). Previous work with the DDH also supports the validity of this measure (Noll et al., 1992). The DDH alcohol consumption data allow for categorization of drinking patterns into quantity-frequency-variability (Q-F-V) indices of heavy, moderate, light, or infrequent drinker, and abstainer (Cahalan, Cisin, & Crossley, 1969). These five categories were collapsed in this study into the following three categories for analyses related to alcohol use due to the small sample sizes in six of the cells: (1) heavy or moderate drinkers, (2) light or infrequent drinkers, and, (3) abstainers. The reported number of cigarettes smoked per day over the last 30 days was used to classify each participant into one of seven categories reflecting daily cigarette use (i.e., from none to two or more packs per day). In this study, these seven categories were collapsed for analyses related to tobacco use into two dichotomous categories (e.g., use and nonuse) due to the small sample sizes in ten of the cells. The frequency of illegal substance use during the past 12 months was used as a current measure of nonalcohol, nontobacco drug use. Finally, the total number of illegal substances ever tried by an individual was used as a measure of lifetime drug experimentation.

**Data Reduction**

Combining multiple sources of information into a single index scale permitted a best-estimate of whether young adult participants were engaging in aggressive or antisocial behavior. This approach minimized the potential negative impact of social desirability and selective reporting on findings. Further, this method of data reduction is supported by literature suggesting that combining young adult and caregiver reports yields a more accurate representation of aggressive and antisocial behavior (e.g., Loeber, Green, Lahey, & Stouthamer-Loeber, 1989).

Primary caregiver (i.e., CBCL) and self-report (i.e., ASB) items of aggressive and antisocial behavior were scored dichotomously (i.e., present or not) to facilitate scale development. Subsequently, a 10-item index scale that combined the information from both sources was created. This scale consisted of items from the two measures that directly overlapped in terms of content (Table I). Because items on the CBCL are less specific and detailed than items on the ASB, several specific items on the ASB corresponded with a single global item on the CBCL. Reports from the two sources were combined such that an endorsement by either source resulted in an endorsement for that item on the index scale. In the case where several specific ASB items corresponded with a single global CBCL item, an endorsement for any item in the ASB cluster resulted in an endorsement for that single global item on the index scale. The 10 items on the index scale were then summed to yield a summary score with a range of 0
A liberal criterion of $\alpha = .05$ was used for all analyses. Two-tailed univariate $t$ tests that examined a variety of demographic variables yielded nonsignificant results. PCS and CC were not different in the area of family SES, with the mean for each group equating to technical, sales, and administrative support occupations (PCS: $M = 43.36, SD = 20.47$; CC: $M = 42.63, SD = 18.50$; $t[50] = .14, \text{ ns}$). In addition, the two groups were not significantly different in estimated intelligence (PCS: $M = 105.08, SD = 14.93$; CC: $M = 104.46, SD = 13.51$; $t[50] = .16, \text{ ns}$) or age at time of evaluation (PCS: $M = 18 \text{ years 8 months}, SD = 11 \text{ months}, \text{ range 17 years 9 months–20 years 11 months}$; CC: $M = 19 \text{ years 0 months}, SD = 11 \text{ months}, \text{ range 18 years 0 months–20 years 11 months}$; $t[50] = -1.22, \text{ ns}$).

### Aggression and Antisocial Behavior

A one-tailed $t$ test was performed to test the hypothesis that PCS would be rated as engaging in fewer aggressive and antisocial behaviors than CC. No significant differences were found between PCS ($M = 3.35, SD = 1.81$) and CC ($M = 3.81, SD = 1.96$) using our 10-item index scale, $t(50) = -.88, \text{ ns}$.

### Substance Use: General Issues

The hypothesis that PCS would report less substance use than CC examined (1) alcohol use, (2) tobacco use, and (3) illegal substance use. Substance use was conceptualized in this way to capture the greatest amount of information regarding usage patterns and to ensure comparability of results to the few previous studies that have examined the use of specific substances within this population (e.g., Hollen & Hobbie, 1993; Tyc et al., 1997). Because substance use may vary by region of the country, it was necessary to compare PCS not only to a regional but also to a national sample to aid in interpretation of any findings. Comparison of PCS to CC who were drawn from the same communities allowed for a regional comparison based on specific patterns of use for the tri-state area. Whenever possible, CC then were compared to national epidemiological statistics of substance use by young adults graduating from high school in the United States in 1998 (Monitoring the Future Study; Johnston, Bachman, O’Malley, Schulenberg, & Wallace, 1998). Whereas the former comparison allowed for greater specificity of findings, this latter comparison ensured generalizability of these findings to the larger population of young adults in the country.

### Alcohol Use

A two-way chi-square test was performed to compare differences between PCS and CC on alcohol use for the 6 months preceding data col-

### Table I. Items Included in the Index Scale

<table>
<thead>
<tr>
<th>CBCL</th>
<th>ASB</th>
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<tr>
<td>1. Truancy, skips school.</td>
<td>Skipped school without legitimate excuse more than 5 days in the school year.</td>
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<tr>
<td>2. Lying or cheating.</td>
<td>Lied to your parents.</td>
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<tr>
<td>3. Swearing/obscene language.</td>
<td>Cursed at your parents (to their face).</td>
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<tr>
<td>4. Physically attacks people.</td>
<td>Hit a teacher or principal.</td>
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<tr>
<td>5. Gets in many fights.</td>
<td>Been suspended or expelled from school for fighting.</td>
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<tr>
<td>6. Vandalism.</td>
<td>Broken street lights, car windows, or car antennae just for the fun of it.</td>
</tr>
<tr>
<td>7. Cruel to animals.</td>
<td>Teased or killed an animal just for the fun of it.</td>
</tr>
<tr>
<td>8. Disobedient at home.</td>
<td>Defied your parents’ authority (to their face).</td>
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<tr>
<td>9. Runs away from home.</td>
<td>Runs away from home for more than 24 hours.</td>
</tr>
<tr>
<td>10. Steals outside the home.</td>
<td>Snatched a woman’s purse. Shoplifted merchandise valued over $25. Shoplifted merchandise valued under $25. Taken part in a robbery. Taken part in a robbery involving physical force or a weapon.</td>
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CBCL = Child Behavior Checklist; ASB = Antisocial Behavior Checklist.
lection. Results from this analysis were not significant for alcohol use by group membership, $\chi^2 (2, N = 52) = 9.0$, ns. Specifically, 46% ($n = 12$) of PCS were classified as abstainers using the Q-F-V index (Cahalan et al., 1969), while 23% ($n = 6$) and 31% ($n = 8$) were classified as infrequent/light and moderate/heavy drinkers, respectively. In comparison, 35% ($n = 9$) of CC met criteria for abstainers, while 23% ($n = 6$) and 42% ($n = 11$) were classified as infrequent/light and moderate/heavy drinkers. Although epidemiological statistics were not available regarding 6-month usage, in particular, the 35% abstinence rate of CC in this study appeared to be in line with expectations based on statistics for rates of annual (25%) and 30-day (48%) abstinence for young adults in the general population (Johnston et al., 1998).

Tobacco Use. A two-way chi-square test was performed to test whether differences existed between PCS and CC on tobacco use for the month preceding data collection. Results from this analysis yielded no significant difference for tobacco use by group membership, $\chi^2 (1, N = 52) = .32$, ns. Descriptively, the majority of participants in both groups reported no current use of tobacco (62%, $n = 16$ of PCS; 54%, $n = 14$ of CC), with the remainder of participants in both groups evenly distributed from light (<1 cigarette per day) to heavy (1½ packs per day) smokers. Data from CC did not differ significantly from epidemiological statistics (Johnston et al., 1998) indicating that 65% of young adults in the general population reported no use of tobacco in the preceding month.

Illegal Substance Use. Two one-tailed $t$ tests were performed to test the hypothesis that PCS would report less illegal substance use than CC. These $t$ tests focused on two distinct areas: (1) total frequency of substance use during the past 12 months and (2) lifetime number of different drugs tried.

Drug use reported for the 12 months immediately preceding data collection was significantly correlated with lifetime amount of drug use ($r = .97, p < .001$). To control for individual variations in the age of initiation to substance use, the former score was used to standardize the time period being summed for frequency. As predicted, PCS ($M = .96, SD = 2.39$) reported significantly less total illegal drug use in the past year than CC ($M = 2.69, SD = 4.44, t [38] = -1.75, p < .05$). PCS reported using some type of illegal drug approximately one to two times during the preceding year, while CC reported using six to nine times, on average. Six follow-up one-tailed $t$ tests were conducted on the individual substances for which a base rate above zero existed for at least one group. A significant difference was found for use of marijuana ($t [48] = -1.73, p < .05$).

A trend also was noted for use of amphetamines, but this effect did not reach statistical significance ($t [25] = -1.656, p = .055$). Comparison with epidemiological statistics (Johnston et al., 1998) indicates that CC did not differ significantly from young adults in the general population on use of marijuana or amphetamines. Fifty percent of CC reported use of marijuana and 12% reported use of amphetamines, in comparison to rates of 49% and 16%, respectively.

A one-tailed $t$ test examining the lifetime number of illegal drugs ever tried also yielded a significant result. On average, PCS ($M = .46, SD = .76$) experimented with fewer drugs than CC ($M = 1.12, SD = 1.51, t [37] = -1.98, p < .05$). Specifically, 69% ($n = 18$) of PCS reported never having used any illegal substances, 15% ($n = 4$) reported use of one substance, and 15% ($n = 4$) reported use of two substances, with no participants reporting use of more than two substances. In contrast, the number and range of substances tried was much greater for CC. Forty-six percent ($n = 12$) of CC reported never having used an illegal substance, 27% ($n = 7$) reported use of one substance, 12% ($n = 3$) reported use of two substances, 8% ($n = 2$) reported use of three substances, 4% ($n = 1$) reported use of four substances, and 4% ($n = 1$) reported use of six different substances.

Six follow-up two-way chi-square tests were conducted on the individual substances for which a base rate above zero existed for at least one group. A significant difference was found for marijuana use only, with a smaller proportion of PCS reporting ever having tried marijuana, $\chi^2 (1, N = 52) = 8.50, p < .01$. Specifically, 54% ($n = 14$) of CC reported having tried marijuana at least once during their lifetime, while only 15% ($n = 4$) of PCS reported marijuana experimentation. Data from CC again did not differ from epidemiological statistics (Johnston et al., 1998) in that 49% of young adults in the general population reported having tried marijuana at least once.

Discussion

The first hypothesis of this study was that PCS would be rated as engaging in fewer aggressive and
antipsychotic behaviors than CC. Findings from this study did not support this hypothesis. No significant differences were found between PCS and CC based on combined report of young adults and their caregivers. The second hypothesis was that PCS would self-report less substance use than CC. This hypothesis was partially supported. No significant differences were found between PCS and CC on current use of alcohol and tobacco. However, PCS did report less use of illegal drugs during the past year than CC. In addition, PCS reported significantly less lifetime drug experimentation. The effect for marijuana use was notably significant. Rates of marijuana use during the past year were significantly lower for PCS than for CC. Additionally, significantly fewer PCS reported having ever tried marijuana than did CC. This finding regarding marijuana use is consistent with the one previous study (Hollen & Hobbie, 1993) that also compared marijuana use in PCS to a nonclinical sample. Findings from Hollen and Hobbie (1993) were nonsignificant but were in the same direction as this investigation.

These results suggest that PCS are functioning as well as, or better than, CC when compared on a variety of risk behaviors at long-term follow-up. Issues of statistical significance aside, all of the findings in this study were in the predicted direction. This consistent support across risk behaviors suggests that the experience of pediatric cancer in early adolescence may exert a subtle protective influence on the development of externalizing behavior in PCS. This finding is consistent with literature that reports PCS are generally well-adjusted and show few signs of psychopathology (e.g., Kazak et al., 1994). In fact, these findings lend support to the few studies which have reported that survivors of pediatric cancer appear to enjoy greater psychological health and well-being than would be expected based on normative data (e.g., Elkin, Phipps, Mulhern, & Fairclough, 1997; Fritz & Williams, 1988). These studies suggest that the experience of pediatric cancer and its treatment may actually result in improved psychosocial outcome for survivors in a variety of distinct areas. This study both supports and extends previous findings by demonstrating that PCS demonstrate decreased vulnerability to illegal drug use.

This study is especially limited by the small sample size and the limited participation of minorities. The small number of participants resulted in poor power (\(d = .54\) for a medium effect) to detect significant differences between PCS and CC. Approximately twice as many participants (51 per group) would have been needed to ensure adequate power (\(d = .80\)) to detect medium effect sizes. Compounding this problem were the low base rates reported for the use of most of the drugs sampled. Low base rates, combined with the small sample size, made statistical significance for the use of a particular drug difficult to achieve. This lack of statistical power may have contributed to the finding of a trend of decreased amphetamine use in PCS, rather than a statistically significant difference, as the base rates for both groups were relatively low and actually approached zero for PCS. Marijuana proved to be the exception, due to the medium effect size (\(d = .48\)) and the fact that base rates for use in both groups were well above zero.

Despite the limitations, this study has important clinical implications. Although results suggest that young adults who are PCS demonstrate significantly less use of illegal substances than CC, the use of drugs in any quantity remains a risk factor that must be addressed. Substance use that could amplify organ damage or increase risk for further malignancies is a significant concern for health care professionals working with this population (Hollen et al., 1997). As can be seen in Table II, PCS are reporting some current use of such substances. This is especially true for alcohol and tobacco use, where many PCS are reporting levels of use similar to that of CC. Tobacco use is of particular concern for this population, as it may place PCS at increased risk for second malignancies.

The difference in results obtained for alcohol and tobacco versus illegal substances may be due to the developmental trajectory of drug use and the time of diagnosis for this sample of PCS. Specifically, the use of alcohol and tobacco generally precedes experimentation with other types of drugs (McCutcheon & Thomas, 1995). For example, peak time for tobacco initiation is reported to be 12 to 14 years of age (Tyc et al., 1997). As PCS were 12 to 15 years of age at the time of diagnosis, some may have already begun using alcohol and tobacco. As a result, the experience of pediatric cancer and its treatment may have served to disrupt the trajectory toward further, illegal drug use, rather than forestalling the development of drug use entirely. Previous work in the area of tobacco use lends support to this model. Although PCS may be less likely than peers to start smoking following diagnosis and treatment, they appear likely to continue smoking once addicted (Haupt et al., 1992; Tao et al., 1998). The results of this study, in conjunction with previ-
ous work, underscore the need for the development of interventions and educational strategies to further reduce these drug-related risk behaviors in PCS. Follow-up programs for the express purpose of education, health promotion, and health maintenance are of vital importance in working with this population to decrease risk over the long term.

Despite the need for further reduction in the use of drugs by PCS, these survivors demonstrated decreased vulnerability in this area. A major contribution of this investigation is its ability to identify an area of relative strength for survivors. This may help to inform clinical decisions regarding where and how resources are directed in terms of educational interventions for this population. Further, studying the mechanisms proposed to underlie the development of this strength might allow for the implementation of effective interventions for other populations who are at risk for early substance use. Increased parental involvement and decreased unsupervised time with peers are two such mechanisms that may have particular relevance to decreasing risk behaviors in nonchronically ill populations.

Future work should focus on understanding the mechanisms that lead to decreased vulnerability for PCS. A multisite study would be beneficial in a variety of ways. First, this study represented nearly every child diagnosed with cancer between ages 12 and 15 in this region during the study period. However, with the addition of multiple sites, the pool of potential participants would be much greater, allowing for greater power to detect significant differences. Second, the medical center at which this study was conducted currently follows the Children’s Cancer Group guidelines for standards of care (Noll & Kazak, 1997). It is conceivable that not all facilities that treat children with cancer follow this framework for providing psychosocial services and long-term medical/educational follow-up. A multisite study randomized on psychosocial services provided to children during and after medical treatment would help to ascertain the generalizability of this study’s results. In addition, this type of study would allow researchers to begin identifying the variables (e.g., age at diagnosis, treatment effects, supportive care services) that mediate the relationship between pediatric cancer treatment and the decreased vulnerability observed in the area of illegal drug use.

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