

# Tobacco Use and Exposure Among Youth Undergoing Cancer Treatment

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## ABSTRACT

**Introduction:** Adolescents with cancer are susceptible to the health consequences associated with secondhand smoke exposure (SHSE) and tobacco use. The present study compared tobacco use, exposure, and risk factors between patients and population peers.

**Method:** Self-reported data on tobacco use, SHSE, and tobacco-related risk factors were drawn from a pediatric oncology hospital and the National Youth Tobacco Survey. Conditional logistic regression was used to estimate odds ratios for patients and control subjects.

**Results:** Patients were as likely to have tried tobacco and report home SHSE as control subjects. Patients were more likely to report car SHSE, less likely to report that SHSE is harmful, and less likely to report home smoking bans.

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**Discussion:** Patients experienced SHSE, tobacco use, and tobacco-related risk factors at rates greater than or equal to control subjects. These results provide support for consideration of intervention targets, health status, and delivery mechanisms, particularly by health care providers, when developing comprehensive tobacco control strategies. *J Pediatr Health Care.* (2015) 29, 80-87.

## KEY WORDS

Adolescent health care, oncology, smoking, tobacco use

Secondhand smoke exposure (SHSE) and tobacco use represent significant health concerns for adolescents receiving treatment for cancer because of their increased health vulnerabilities as a result of cancer treatment and genetic predisposition (Bhatia et al., 2003; Geenen et al., 2007; Huang et al., 2011; Hudson et al., 2003; Miller et al., 2010; Oeffinger et al., 2006). Pediatric cancer survivors are at increased risk for experiencing adverse health outcomes such as cardiovascular disease, stroke, kidney failure, pulmonary fibrosis, and second malignancies (Bhatia et al., 2003; Geenen et al., 2007; Huang et al., 2011; Hudson et al., 2003; Miller et al., 2010; Oeffinger et al., 2006), conditions that may also be the result of, or exacerbated by, tobacco use or exposure (Kahalley et al., 2012; U.S. Department of Health and Human Services, 2004). Despite increased risk for secondary health consequences, children with cancer exhibit rates of SHSE that are similar to those of the general population (Centers for Disease Control and Prevention [CDC], 2010; Kahalley et al., 2012; Tyc, Klosky, Throckmorton-Belzer, Lensing, & Rai, 2004a; Tyc, Lensing, Vukadinovich, & Hovell, 2009b; Tyc, Throckmorton-Blezer, et al., 2004b). Although rates of current smoking among adolescents receiving treatment for cancer have been reported to be lower than those of their healthy peers (CDC, 2013; Tyc, Hovell, & Winickoff, 2008), rates of tobacco use among adolescent survivors (15%-38%) are generally

equivalent (CDC, 2010; Kahalley et al., 2012; Klosky et al., 2012; Tyc, 2008). These findings are concerning because lower rates of exposure and smoking are desired among these youth as a result of their increased risk for tobacco-related morbidities and increased opportunities for tobacco interventions from health care providers (HCPs).

Consequently, preadolescence and adolescence represent critical periods for engagement in behavioral health decision making for protective health behaviors, such as SHSE avoidance (Ding et al., 2010) and risky health behaviors, including smoking initiation and progression (Turner, Mermelstein, & Flay, 2004). In fact, SHSE and smoking initiation in adolescence are closely related, because exposure is a frequent consequence of parental smoking, and parental smoking has been associated with greater adolescent intentions to smoke, early onset, rapid escalation, and long-term persistence of smoking (Best, Committee on Environmental Health, Committee on Native American Child Health, & Committee on Adolescence, 2009; CDC, 2007; Chassin, Presson, Pitts, & Sherman, 2000; Ding et al., 2010). Parental smoking has also been identified as a risk factor for tobacco use among adolescent cancer survivors (Kahalley et al., 2012). Furthermore, parental smoking, the most common source of SHSE (Ding et al., 2010), also serves as a risk factor for adolescent smoking through mechanisms such as modeling, increased access to tobacco (Best et al., 2009; Chassin et al., 2000; Chassin, Presson, Rose, Sherman, & Prost, 2002; Flay, Hu, Siddiqui, Day, & Hedeker, 1994), or genetic predisposition for addiction to nicotine that leads children to adopt the habit themselves (Boomsma, Koopsman, Van Doornen, & Orlebeke, 1994). Beyond parental smoking, research has also established both fixed and modifiable risk factors associated with adolescent tobacco use. Risk factors include sociodemographic factors (e.g., age, socioeconomic status [SES], and gender; Backinger, Fagan, Matthews, & Grana, 2003; CDC, 2008; DiFranza et al., 2007; Gilpin, Choi, Berry, & Pierce, 1999; Johnston, O'Malley, Bachman, & Schulenberg, 2012), psychosocial factors (e.g., intentions to smoke, perceptions of mortality risk, and perceived social value of smoking; Ellickson, McGuigan, & Klein, 2001; Lundborg & Andersson, 2008; Tyc, Klosky, Lensing, Throckmorton-Belzer, & Rai, 2009a), and social factors (e.g., having friends who smoke; Chassin, Presson, Sherman, Montello, & McGrew, 1986). All of these aforementioned factors are important and can inform tobacco assessment and intervention planning. Thus, these developmental periods represent key surveillance and intervention targets for health behaviors, especially among youth at risk for adverse health outcomes.

Three previous studies have compared the rates of tobacco use and related risk factors for youth with and without cancer by separately examining preadolescents

(8-11 years; Tyc, Klosky, et al., 2009a) and adolescents (12-18 years; Kahalley et al., 2012; Tyc, Lensing, Klosky, Rai, & Robinson, 2005). Tyc and colleagues (Tyc et al., 2009a,b) focused on youth's intention to smoke and found that nonsmoking healthy preadolescents reported more intentions to smoke and perceived social value of smoking compared with children who had cancer. Alternatively, preadolescents with cancer reported more tobacco-related knowledge, perceptions about their vulnerability to tobacco health risks, optimism, and value of overall health. In a similar study, adolescents with cancer reported less current smoking (2% vs. 22%) and fewer intentions to smoke than a matched comparison of healthy peers from the local community but reported similar rates of past smoking behavior (20% vs. 18%; Tyc et al., 2005). A recent study compared smoking between adolescent survivors of cancer and their siblings and found no significant differences in either having a history of smoking or active smoking (Kahalley et al., 2012). Further, risk factors for smoking among adolescent survivors included having friends who smoke and living in a household with smokers (Kahalley et al., 2012). Taken together, these results suggest that youth with cancer report similar rates of a history of smoking, lower or comparable rates of current smoking, established risk tobacco factors of peer smoking and household exposure to smokers, and fewer individual-level tobacco-related risk factors compared with their healthy peers.

No previous studies have concurrently examined SHSE, tobacco use, and risk factors among both preadolescents and adolescents receiving treatment for cancer and compared these rates to national data. Previous research has (a) explored these constructs separately and among either preadolescents or adolescents or (b) utilized local comparison groups (e.g., local schools) or sibling comparison groups rather than national data. The current study extended previous research by comparing rates of SHSE, tobacco use, and other potential tobacco-related risk factors in pediatric patients with cancer (patients in the current study are being treated at an institution with a large representation of referral areas; Umbach, 2013) to a larger, nationally representative sample of youth (10-18 years) using a matched-controlled design. Further, the present study simultaneously examined SHSE and tobacco use (Klosky et al., 2012; Tyc, 2008; Tyc et al., 2009a,b; Tyc et al., 2004a,b), using statistical methods recommended for matched-controlled designs, with the aim of exploring a more comprehensive surveillance of health behaviors (Niven, Berthiame, Fick, & Laupland, 2012). Additionally, prevalence rates were examined by preadolescent and adolescent age groups to explore any developmental differences that may exist in these tobacco outcomes. Examination of these deleterious health behaviors and plausible differences between medically compromised and healthy groups will help

inform both researchers and clinicians on effective tobacco control approaches when working with pediatric patients who have cancer and their families.

## METHODS

Youth reports on the prevalence of exposure, tobacco use, and associated risk factors were collected from two datasets: the National Youth Tobacco Survey (NYTS; CDC, 2006) and baseline data from a study examining SHSE among children receiving treatment for cancer (Tyc et al., 2013). These two surveys were conducted within the same time frame (2002–2006), thus reducing the risk for cohort effects, and included comparable behavior-based tobacco items. To differentiate, the two samples will be referred to as the *NYTS* and *pediatric patients with cancer*. Although prevalence rates will specifically be examined between preadolescents (10–12.9 years) and adolescents (13–18 years), more general terms will be used when describing comparisons that were made which collapse the age groups, such as “youth.”

## Participants

### Pediatric patients with cancer

Patient self-reports were drawn from the baseline assessment of a randomized controlled intervention trial designed to reduce SHSE among children receiving active treatment for cancer. Details of the clinical trial are presented elsewhere (Tyc et al., 2013). Families were recruited from the outpatient clinics of a large pediatric oncology hospital. Eligible participants had at least one adult smoker residing in the home and were required to be receiving active treatment for cancer, at least 30 days after diagnosis, and abstinent from tobacco use during the prior month. Comparable criteria (except the cancer-related criteria) were applied to the national sample such that only NYTS youth who lived with a smoker, but did not currently smoke themselves, were included.

Pediatric patients were on average 13.9 years of age ( $SD = 2.3$ ; range, 9.7–17.7 years). Preadolescents ( $n = 21$ ; range, 9.7–12.9 years) and adolescents ( $n = 44$ ; range, 13.2–17.7 years) were given parallel versions of the study survey with minimal adjustments for reading level. The majority of participants were White (72.4%), and 62.1% were male (see Table 1). Children came from low (43.1%), middle (27.6%), and high SES families (29.3%) as measured by the Hollingshead index (Hollingshead, 1975). Patients were receiving treatment for central nervous system disease ( $n = 4$ ; 6.9%), leukemia/lymphoma ( $n = 45$ ; 77.6%), and solid tumors ( $n = 9$ ; 15.5%). Questionnaire completion occurred an average 5.0 months from the time of diagnosis.

### National Youth Tobacco Survey

NYTS is a national survey ( $N = 27,038$ ) administered to middle school and high school students (grades 6–12;

CDC, 2006). The survey covers topics such as tobacco-related beliefs, attitudes, behaviors, and SHSE. The sample pool was reduced to 8,610 youth using the same inclusion criterion as the cancer sample: (a) 9.7 to 17.7 years of age at the time of survey completion; (b) no cigarette or smokeless tobacco (ST) use in the previous month as an indication of active smoking; and (c) living with at least one smoking adult (Tyc et al., 2013). To create a comparison sample, pediatric patients with cancer were randomly matched to NYTS youth in a one-to-three ratio based on age, gender, and ethnicity. Table 1 provides information on the two comparison groups and demonstrates the integrity of the matching based on age, ethnicity, and gender.

## Measures

### Demographic and diagnostic variables

For youths with cancer, child age, gender, race, diagnosis, and parents' SES and marital status were collected from parent reports and hospital records. Youth from NYTS self-reported age, gender, and race.

### Youth tobacco exposure

**SHSE.** Questions detailing exposure to SHSE in the home and car were consistent across the two studies and based on previous national tobacco surveys (Farrelly, Chen, Thomas, & Heaton, 2001), but response options were limited for preadolescent patients. NYTS youth and adolescent patients were asked how many days they were in the same room (or car) as someone who was smoking in the past 7 days (range: 0–7). For analytic purposes, this variable was dichotomized (yes/no) into whether exposure occurred in the past 7 days, because preadolescent patients were only asked whether they were exposed in the past 7 days.

**Smoking history.** Youth were queried separately about their tobacco use history for both cigarettes and ST. Pediatric youth with cancer were asked to choose between the following choices: (a) “I have never smoked cigarettes (or used ST)”; (b) “I have smoked a cigarette or a few cigarettes (tried ST) but have not smoked in the past month”; (c) “I have smoked one or more cigarettes (used ST) in the past month”; and (d) “I have smoked one or more cigarettes (used ST) in the past week.” These questions were dichotomized (never used vs. used) to match the questioning of the NYTS (“Have you ever tried cigarette smoking (chewing tobacco, snuff, or dip), even one or two puffs?”).

### Tobacco use and exposure risk factors

Youth reported on three risk factors for tobacco use and exposure: number of friends who smoke, whether their home is smoke free, and perceptions of SHSE harm. NYTS youth were asked, “How many of your four closest friends smoke cigarettes?” and pediatric cancer

**TABLE 1. Demographics for pediatric patients with cancer and National Youth Tobacco Survey**

|                      | Pediatric cancer sample    |                         |                      | National Youth Tobacco Survey |                          |                       |
|----------------------|----------------------------|-------------------------|----------------------|-------------------------------|--------------------------|-----------------------|
|                      | Preadolescents<br>(n = 21) | Adolescents<br>(n = 37) | Combined<br>(n = 58) | Preadolescents<br>(n = 63)    | Adolescents<br>(n = 111) | Combined<br>(n = 174) |
| Gender (male), % (n) | 66.7 (14)                  | 59.5 (22)               | 62.1 (36)            | 66.7 (42)                     | 59.5 (66)                | 62.1 (108)            |
| Ethnicity, % (n)     |                            |                         |                      |                               |                          |                       |
| White                | 66.7 (14)                  | 75.7 (28)               | 72.4 (42)            | 66.7 (42)                     | 75.7 (84)                | 72.4 (126)            |
| African American     | 28.6 (6)                   | 24.3 (9)                | 25.9 (15)            | 28.6 (18)                     | 24.3 (27)                | 25.9 (45)             |
| Asian                | 4.8 (1)                    | 0                       | 1.7 (1)              | 4.8 (1)                       | 0                        | 1.7 (3)               |
| Age, M (SD)          | 11.37 (.92)                | 15.40 (1.34)            | 13.94 (2.29)         | 11.42 (.50)                   | 15.43 (1.31)             | 13.98 (2.22)          |

Note. Percentages that do not add up to 100% for any given category indicate missing data due to the participant not completing that item.

youth were queried, “How many of your best friends smoke?” Both were categorized into the following response options: 0 friends, 1 friend, or more than 1 friend. To assess the presence of a smoking ban, or a smoke-free home environment, youth from both studies were asked what rules about smoking existed inside their home. Although response options differed slightly, both were dichotomized to differentiate between homes where smoking is/is not allowed. In regard to perceptions of harmfulness, youth from both studies were asked, “Do you think the smoke from other people’s cigarettes is harmful to you?” Although the question was identical for both studies, response options differed (NYTS: definitely yes, probably yes, probably no, definitely not; pediatric cancer: not at all harmful, a little harmful, somewhat harmful, extremely harmful). Response options were recoded to the following options to represent youth’s perception of the harmfulness of SHSE: harmful, maybe harmful, and not harmful.

### Data Analysis

A three-to-one match of the national sample to the pediatric cancer sample resulted in a total sample of 232 youth (NYTS:  $n = 174$ ; pediatric cancer:  $n = 58$ ). First, the prevalence of exposure (home and car), tobacco use, and potential tobacco risk factors (number of smoking friends who smoke, household smoking rules, and perceptions of SHSE harmfulness) are presented for both samples. Prevalence rates were also provided for preadolescent and adolescent groups separately, although sample sizes were too small to examine statistical group differences, in order to examine developmental trends. Given the gender differences for smokeless tobacco use (Johnston et al., 2012), the gender of youth that reported tobacco use history is provided. Finally, conditional logistic regression was used to compute odds ratios and 95% confidence intervals of tobacco use, exposure, and risk factors between youth receiving treatment for cancer and the national comparison sample (Niven et al., 2012). The final model included all five tobacco use, exposure, and tobacco risk variables simultaneously. Significance levels for all statistical tests were set at a  $p$  value less than .05.

## RESULTS

### Prevalence Rates of SHSE, Tobacco Use, and Risk Factors

#### Pediatric patients with cancer

For the full pediatric cancer sample, 66.7% of youth reported being exposed in the home, 75.9% reported being exposed in the car, and 55.2% ( $n = 32$ ) reported exposure from both sources during the previous week (see Table 2 for further descriptive statistics). Approximately 28% of the sample (14 males and 2 females) endorsed a history of smoking. Males were significantly more likely to report a history of tobacco use: cigarettes:  $\chi^2(1, n = 57) = 6.4, p = .01$ ; ST:  $\chi^2(1, n = 57) = 4.2, p = .05$ . Regarding tobacco-related risk factors, approximately 28% of youth reported having at least one smoking friend; 66.7% reported that smoking was allowed in the home; and 19.3% reported that SHSE was not harmful (see Table 3). Regarding developmental differences, adolescents reported more SHSE, tobacco use, smoking friends, and knowledge of SHSE harm; however, adolescents reported a similar rate of smoking being allowed in the home when compared with preadolescent patients.

#### National Youth Tobacco Survey

For the national sample, 64.9% reported home SHSE during the past week, 51.7% reported exposure in the car, and 46.6% reported SHSE in both locations ( $n = 81$ ). Approximately one quarter of the sample (29 males and 15 females) had a history of smoking and 4.6% (7 males and 1 female) had used ST (see Table 2). No gender differences were detected. For tobacco-related risk factors, 27.6% of the national sample reported having friends who smoke; 58% reported that smoking was allowed in their home; 68.4% reported that SHSE was harmful, and 2.9% reported that SHSE was not harmful (see Table 3). Regarding developmental differences, similar to the pediatric sample, adolescents reported more home SHSE, tobacco use, friends who smoke, and knowledge of SHSE harm. However, among the national sample, adolescents reported similar rates of SHSE in the car and increased rates of smoking being allowed in the home when compared with preadolescents.

**TABLE 2. Comparisons of pediatric cancer and National Youth Tobacco Survey youth for secondhand smoke exposure and tobacco use broken down into age groups**

|                          | Full samples <i>n</i> (%) |            | Preadolescents <i>n</i> (%) |           | Adolescents <i>n</i> (%) |            |
|--------------------------|---------------------------|------------|-----------------------------|-----------|--------------------------|------------|
|                          | Pediatric patients        | NYTS       | Pediatric patients          | NYTS      | Pediatric patients       | NYTS       |
| Home SHSE in past week   |                           |            |                             |           |                          |            |
| No exposure              | 19 (33.3)                 | 61 (35.1)  | 11 (52.4)                   | 25 (39.7) | 8 (22.2)                 | 36 (32.4)  |
| Exposure                 | 38 (66.7)                 | 113 (64.9) | 10 (47.6)                   | 38 (60.3) | 28 (77.8)                | 75 (67.6)  |
| Car SHSE in past week    |                           |            |                             |           |                          |            |
| No exposure              | 14 (24.1)                 | 84 (48.3)  | 8 (38.1)                    | 31 (49.2) | 6 (16.2)                 | 53 (47.7)  |
| Exposure                 | 44 (75.9)                 | 90 (51.7)  | 13 (61.9)                   | 32 (50.8) | 31 (83.8)                | 58 (52.3)  |
| Smoking status           |                           |            |                             |           |                          |            |
| No history of smoking    | 41 (71.9)                 | 130 (74.7) | 17 (81.0)                   | 56 (88.9) | 24 (66.7)                | 74 (66.7)  |
| History of smoking       | 16 (28.1)                 | 44 (25.3)  | 4 (19.0)                    | 7 (11.1)  | 12 (33.3)                | 37 (33.3)  |
| Smokeless tobacco status |                           |            |                             |           |                          |            |
| No history of ST use     | 51 (89.5)                 | 166 (95.4) | 20 (95.2)                   | 62 (98.4) | 31 (86.1)                | 104 (93.7) |
| History of ST use        | 6 (10.5)                  | 8 (4.6)    | 1 (4.8)                     | 1 (1.6)   | 5 (13.9)                 | 7 (6.3)    |

Note. NYTS, National Youth Tobacco Survey; SHSE, secondhand smoke exposure; ST, smokeless tobacco. Self-reports were available from 58 pediatric youth with cancer because of the 3:1 matching with 174 youth from the national dataset. Columns that do not equal these totals indicate item-level missing data.

**COMPARISONS BETWEEN PEDIATRIC AND NATIONAL SAMPLES**

The difference in likelihood of trying tobacco products between the patients with cancer and the healthy teens was not significant (odds ratio [OR] = 0.51; 95% confidence interval [CI] [0.20, 1.33]), suggesting that the pediatric patients with cancer were no more or less likely to try tobacco products than were the youth without cancer. The pediatric patients with cancer were less likely to report that SHSE was harmful when compared with their healthy peers (OR = 0.30; 95% CI [0.16, 0.54]). The pediatric patients with cancer and matched comparison group reported no difference in risk of being exposed to SHS in the home (OR = 0.39, 95% CI [0.14, 1.06]) or having a friend who smokes (OR = 1.06, 95% CI [0.75, 1.48]). However, youth with cancer were found to be approximately four times more likely to be exposed to tobacco smoke in the car (OR = 4.15, 95%

CI [1.51, 11.39]) and were less likely to report having smoking bans in their household (OR = 0.41, 95% CI [0.18, 0.93]) when compared with teens without cancer.

**DISCUSSION**

Youth receiving treatment for cancer reported equivalent or increased rates of SHSE and tobacco use compared with youth in the general population, despite their compounded risk for adverse health outcomes (Bhatia et al., 2003; Geenen et al., 2007; Huang et al., 2011; Hudson et al., 2003; Kahalley et al., 2012; Miller et al., 2010; Oeffinger et al., 2006; U.S. Department of Health and Human Services, 2004). Rates of home SHSE and tobacco use among patients were comparable with those of their healthy peers, but youth receiving treatment for cancer reported more SHSE in the car. Regarding risk factors for tobacco use, fewer pediatric patients with cancer

**TABLE 3. Comparisons of pediatric cancer and National Youth Tobacco Survey youth for tobacco risk-factors broken down into age groups**

|                          | Full samples <i>n</i> (%) |            | Preadolescents <i>n</i> (%) |           | Adolescents <i>n</i> (%) |           |
|--------------------------|---------------------------|------------|-----------------------------|-----------|--------------------------|-----------|
|                          | Pediatric patients        | NYTS       | Pediatric patients          | NYTS      | Pediatric patients       | NYTS      |
| Smoke-free home status   |                           |            |                             |           |                          |           |
| No smoking allowed       | 19 (32.8)                 | 73 (42.0)  | 7 (33.3)                    | 29 (46.0) | 12 (32.4)                | 44 (39.6) |
| Smoking allowed          | 39 (66.7)                 | 101 (58.0) | 14 (66.7)                   | 34 (54.0) | 25 (67.6)                | 67 (60.4) |
| Perceptions of SHSE harm |                           |            |                             |           |                          |           |
| Not harmful              | 11 (19.3)                 | 5 (2.9)    | 7 (33.3)                    | 4 (6.3)   | 4 (11.1)                 | 1 (0.9)   |
| Maybe harmful            | 20 (35.1)                 | 50 (28.7)  | 6 (28.6)                    | 19 (30.2) | 14 (38.9)                | 31 (27.9) |
| Harmful                  | 26 (45.6)                 | 119 (68.4) | 8 (38.1)                    | 40 (63.5) | 18 (50.0)                | 79 (71.2) |
| No. of friends who smoke |                           |            |                             |           |                          |           |
| 0                        | 42 (72.4)                 | 126 (72.4) | 16 (76.2)                   | 51 (81.0) | 26 (72.2)                | 75 (67.6) |
| 1                        | 8 (13.8)                  | 24 (13.8)  | 3 (14.3)                    | 6 (9.5)   | 5 (13.9)                 | 18 (16.2) |
| > 1                      | 8 (13.8)                  | 24 (13.8)  | 2 (9.5)                     | 6 (9.5)   | 6 (16.2)                 | 18 (16.2) |

Note. NYTS, National Youth Tobacco Survey; SHSE, secondhand smoke exposure. Self-reports were available from 58 pediatric youth with cancer because of the 3:1 matching with 174 youth from the national dataset. Columns that do not equal these totals indicate item-level missing data.

reported living in smoke-free homes and they reported more ambivalence about SHSE harm, suggesting potentially more tobacco-related risk factors compared with healthy peers. Further, subjective examination of prevalence rates among pediatric patients indicated that adolescents demonstrated increased tobacco use, SHSE, friends who smoke, and perceived harmfulness of SHSE compared with preadolescents. These results warrant a more comprehensive and aggressive tobacco control approach for youth receiving treatment for cancer.

**Regarding risk factors for tobacco use, fewer pediatric patients with cancer reported living in smoke-free homes and they reported more ambivalence about SHSE harm, suggesting potentially more tobacco-related risk factors compared with healthy peers.**

The Behavioral Ecological Model may provide an appropriate framework for conceptualizing how unique factors associated with the child's diagnosis, medical treatment, and clinical setting may support behavioral change for both youth and their parents (Hovell & Hughes, 2009; Tyc et al., 2008). Numerous parental factors have been identified as protective or risk factors, and most prior interventions have focused on reducing exposure among youth via parent-directed interventions targeting these behaviors and attitudes associated with adolescents' personal tobacco use and exposure (Best et al., 2009; Chassin et al., 2000, 2002; Ding et al., 2010; Lantz et al., 2000; Petrie, Bunn, & Byrne, 2007; Tyc et al., 2008). Parents of children with medical problems may be more amenable to health behavior change because their children's health is compromised (Hovell, Zakarian, Wahlgren, & Matt, 2000), and youth may simultaneously benefit from targeted interventions as they are increasing their personal health decision making (Ding et al., 2010; Turner et al., 2004).

The health care system holds promise as an intervention site because of HCPs' regular access to both the children and parent during visits. Within this environment, individual factors (for the patient and parent) and socioenvironmental variables might be addressed in the same intervention, allowing for simultaneous tobacco messaging to children and parents. Interventions could focus on behavioral strategies that impact modifiable factors at the individual level, such as perception of harm, and at the socioenvironmental level, such as parental smoking and health behavior choices that remove youth from SHSE (i.e., from peers or through

smoking bans; Ding et al., 2010). Brief clinician-delivered interventions have been effective in modifying adolescent survivors' perceptions of health risks (Tyc et al., 2003), reducing child SHSE, and decreasing tobacco-use initiation and use (Hovell et al., 2000; Rosen, Noach, Winicoff, & Hovell, 2012; Song et al., 2009a,b; Song, Glantz, & Halpern-Felsher, 2009a).

This study is the first to examine differences between pediatric patients with cancer and national data using a matched control design and suggested statistical techniques (Niven et al., 2012). Studies have found that pediatric patients with cancer exhibit rates of SHSE similar to those of the general population but report more tobacco risk perceptions and fewer intentions to smoke (CDC, 2010; Kahalley et al., 2012; Klosky et al., 2012; Tyc, Klosky, et al., 2004a; Tyc, Throckmorton-Belzer, et al., 2004b; Tyc et al., 2009a,b). The present study largely replicates similar tobacco-related risk and use compared with healthy peers; however, differences found between the samples are more concerning for the pediatric youth with cancer because SHSE in the car is higher and smoking bans and perceptions of the harmfulness of SHSE are lower for youth with cancer. The slight discrepancies in these results are likely due to methodological differences, such as the choice of the comparison population (local vs. national), how smoking history was measured (past and current vs. a dichotomy of "never" or "ever"), and the simultaneous inclusion of preadolescents and adolescents where the cut-off age for adolescents is 13 years (compared with 12 years for previous studies). Overall, current and past studies present a common message: Contrary to what would be expected given their compromised health status, youth's history of tobacco use and exposure are comparable across youth with and without cancer. This finding highlights the need for comprehensive surveillance and intervention efforts focused on health behaviors that could both aim to decrease the prevalence of deleterious health behaviors and increase the prevalence of positive health behaviors (e.g., SHSE avoidance, nonsmoking status, home smoking bans, and increased parental monitoring).

Important limitations must be acknowledged and should be considered for future studies. First, sample

**Overall, current and past studies present a common message: Contrary to what would be expected given their compromised health status, youth's history of tobacco use and exposure are comparable across youth with and without cancer.**

size and eligibility requirements for patients with cancer in this study limited generalizability. Generalizability was further limited because of the potentially narrow scope of the questions asked. For example, it would be relevant to consider access to tobacco products and other smoking-related beliefs. In addition, although patients were instructed on confidentiality, response bias may be an issue given the age and health status of this sample. Lastly, the preliminary nature of this study limited the use of more sophisticated analyses examining potential predictors of use or exposure.

In summary, tobacco control interventions targeting youth receiving treatment for cancer may be informed by aspects of programming designed for healthy youth but must also address unique challenges associated with the cancer diagnosis and treatment at the individual and socio-environmental levels (Tyc et al., 2008; Hovell & Hughes, 2009). The current findings have important implications for developing programming targeting and integrating parents, HCPs, and youth to reduce SHSE and tobacco use, congruent with the National Action Plan for Cancer Survivorship priority needs (CDC & Lance Armstrong Foundation, 2004).

The National Plan highlights the importance of the enhancement of cancer survivorship through improved surveillance, prevention, and intervention efforts, especially implementation on a public health level (e.g., utilizing the health care system, an influential delivery system for improving adolescents' behavioral health decision making; Alfano, Zbikowski, Robinson, Klesges, & Scarinci, 2002; Hum, Robinson, Jackson, & Ali, 2011).

Early and consistent assessment of deleterious health behaviors and risk factors could reduce tobacco-use initiation and risk for the development of tobacco-related morbidities among this sensitive population.

**Early and consistent assessment of deleterious health behaviors and risk factors could reduce tobacco-use initiation and risk for the development of tobacco-related morbidities among this sensitive population.**

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