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ORIGINAL REPORT

Testis Cancer Survivors' Health Behaviors: Comparison With Age-Matched Relative and Demographically Matched Population Controls

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ABSTRACT

Purpose
To determine the prevalence rate of health behaviors in testis cancer survivors and to determine whether the rate of health behaviors in survivors was significantly different than those of their age-matched relative controls and a population-based control group matched for age, sex, education, and income.

Patients and Methods
The health behaviors of 162 testis cancer survivors were compared with their age-matched relative controls (n = 74) and an age-, sex-, education-, and income-matched population-based control group (n ranged from 1,123 to 9,775). Health behaviors were assessed with the telephone-administered Behavioral Risk Factor and Surveillance Survey.

Results
Nearly one in five testis cancer survivors reported current smoking and one third reported problem drinking. Only 11% reported having at least five servings of fruits and vegetables per day. Compared with their relative controls, the survivors were more likely to engage in regular exercise. For those participants who drank, survivors were twice as likely to engage in problem drinking and averaged a higher number of drinks compared to their Centers for Disease Control (CDC) controls. Survivors were also half as likely to have at least five servings of fruits and vegetables per day compared with the CDC controls.

Conclusion
The overall picture regarding testis cancer survivors' health behaviors was mixed compared with the relative and CDC control groups. Our results suggest that reduced alcohol use and increased fruit and vegetable consumption may be important targets for future disease prevention in testis cancer survivors.

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INTRODUCTION

Testis cancer is considered largely curable.[1,2] Since incidence is highest among 15 to 39 year olds, the expected period of survivorship extends into decades. However, survivors are at higher risks for secondary neoplasia (odds ratio [OR], 1.4)[3] and cardiovascular morbidities (OR ranges from 2.4 to 7.1).[4,5] Behavioral factors, such as smoking, diet, alcohol consumption, and cancer screening, are an important pathway for disease prevention.[6,7] It would be useful to know how often testis cancer survivors (TCS) engage in healthy behaviors and whether their behaviors differ from noncancer control groups.[8,9] Such knowledge would identify targets for future intervention programs to improve TCS' long-term health outcomes after cancer treatment.

The purposes of our study were to determine the prevalence rate of health behaviors in TCS, and to determine whether the rate of health behaviors in the TCS was significantly different than that of their age-matched relative controls and age-, sex-, education-, and income-matched population controls. Although we did not have an a priori hypothesis, we anticipated that the survivors would experience their cancer as a teachable moment and exhibit a healthier behavior profile than their controls. For example, large population-based comparisons of TCS with age-matched controls reported that TCS had higher levels of physical activity[10] and were more likely to meet Centers for Disease

Control (CDC)/American College of Sports Medicine physical activity recommendations after controlling for demographic and health characteristics.[11]

We measured the frequency of current smoking, cholesterol screening, diet, physical activity, problem drinking, and number of monthly average drinks with the CDC's Behavioral Risk Factor and Surveillance Survey (BRFSS)'s telephone-administered retrospective interview with 162 TCS who were treated 2 to 10 years previously. We then compared the frequencies of these behaviors with two types of control groups: age-matched male relatives of the TCS (n = 74) and a 1999 population-based sample of BRFSS participants (n ranged from 1,123 to 9,775) matched for sex, age, education, and income. The matched male relatives offer a degree of control over the use of population-based participants since the male relatives and TCS are from similar cultural and socioeconomic backgrounds, whereas comparison with the population-based sample provides less experimental control but wider generalizability.

PATIENTS AND METHODS

Background Study

Between January 2000 and June 2002, data were collected as part of a larger cross-sectional study assessing quality of life concerns among 162 TCS who were 2 to 10 years postdiagnosis and 74 age-matched male relative controls.

Study Design and Sample

TCS. TCS were eligible for the study if they were: age 18 to 60; diagnosed with seminomatous or nonseminomatous germ-cell testis cancer between 2 to 10 years before evaluation; residing in the United States; and able to give informed consent. Patients were ineligible if they were not treated at M.D. Anderson (second opinion only) since their treatment information was not accessible. Four hundred forty-one potential participants were identified using a list of patients with testis cancer who were treated at the M.D. Anderson Genitourinary Center. Of these, 212 patients (45.9%) were unable to be contacted due to incorrect addresses or phone numbers. This rate is consistent with Huddart et al,[4] who successfully contacted 680 (49.9%) of 1,363 TCS after 5 years, Hao et al,[12] who successfully reached 35% of 76 TCS 2 years post-treatment, and M.D. Anderson's Medical Informatics tracking success rate with TCS of 60% using professional searching services. We attribute this to the relatively young age of TCS at diagnosis (late 20s and early 30s) and being in a more mobile phase in their life. When there was no indication of bad contact information, patients were assumed to be unreachable after five attempts (with varying times of day and evening for telephone calling). The remaining 229 patients were approached either in-person during their follow-up appointments at the center or via letter and telephone if they were not receiving follow-up at M.D. Anderson. Thirty-seven refusals were received either in the form of a return postcard included in the letters or in-person. The remaining 192 patients agreed to participate and provided consent either in-person or by telephone (telephone consenters were mailed a consent form with a return envelope), yielding a participation agreement rate of 83.8% of eligible survivors who could be reached (192 of 229). Of the 192 participants who provided consent, 162 completed the interview.

Analyses comparing the medical and demographic characteristics of the 162 participants versus the 212 unreachable survivors revealed no differences between the two groups in disease stage ($P = .35$) or histology at time of last contact ($P = .28$; see previous study for further detail).[13]

Relative controls. Controls were identified by asking the survivors for the names of living male relatives who were within 10 years of their age. Relatives were defined as brother, step-brother, first cousin, and brother-in-law, in that order of preference. Eligibility criteria for the age-matched relative controls included: between the ages of 18 and 80; within 10 years of the survivor's age; residing in the United States; English speakers; and able to give informed consent. Relatives were excluded if they had had a previous diagnosis of cancer (other than basal cell skin cancer). Just 60 TCS referred 74 age-matched relative controls, and all 74 completed the interview (70% were brothers, 15% were cousins, 13% were brother-in-laws, 2% were step-brothers). χ^2 analyses indicated no significant differences between survivors and their relative controls for either education ($P = .81$) nor income ($P = .12$).

CDC controls. Responses for the CDC controls were taken from the CDC's 1999 BRFSS data set. We identified people in the CDC data set that matched each of the controls on sex, age, income status, and education level. On a few occasions, two TCS had the same demographic profile; in these cases, subsets of the matching CDC were randomly selected so that each control was matched to just one TCS. χ^2 analysis comparing the proportion of the CDC and TCS samples who were white versus nonwhite were not significant ($P = .53$).

Measures

Demographics. Age was measured as a continuous variable. Race was collapsed into two categories, white or nonwhite, due to the low number of African American, nonwhite Hispanic, Asian, and Pacific Islander survivors. Education was dichotomized into two levels, college graduate or higher versus

Table 1. Demographics and Clinical Characteristics

Parameter	Testis Cancer Survivors			Age-Matched Relative Controls		
	Counts	%	SE	Counts	%	SE
Time since treatment, years	4.5		1.6			
Type						
Seminomatous	53	33				
Nonseminomatous	109	67				
Stage at diagnosis						
I	50	31				
II (A/B/C)	58	36				
III	15	9				
Education						
Never attended school/ only kindergarten	0	0		0	0	
Grades 1-11	8	4.9	0.17	3	4.1	0.23
Grade 12/GED	25	15.4	0.28	10	13.5	0.40
College 1-3 years	46	28.4	0.35	18	24.3	0.50
College 4+ years	83	51.2	0.39	43	58.1	0.57
Refused	0	0	—	0	0	—
Total	162			74		
Income, $						
< 25,000	27	16.7	0.29	5	6.8	0.29
25,000-49,999	35	21.6	0.32	20	27	0.52
50,000-74,999	29	17.9	0.30	12	16.2	0.43
75,000+	67	41.4	0.39	36	48.7	0.58
Do not know/not sure	1	0.6	0.06	1	1.4	0.14
Refused	3	1.9	0.11	0	0	—
Total	162			74		
Race						
White	141	87	0.26	66	89.2	0.36
Other	21	13	0.26	8	10.8	0.36
Total	162			74		
Age, years						
Median		37			39	
Range		20-59			20-59	
Mean age		37.2			38.5	
Standard deviation		9.0			9.2	

NOTE. — indicates that SE is not estimable because of zero cell counts.
Abbreviation: GED, general equivalency degree.

some college education or lower. Income was categorized into three levels, ranging from less than $25,000 per year to more than $74,000 per year.

Health behaviors. All health behaviors were measured by items on the 1999 BRFSS, which demonstrated adequate-to-high reliability (r ranged from 0.63 to 0.77 for the physical activity items, $r = .49$ to 77 for the fruit and vegetable items, $r = 0.81$ to 0.92 for the smoking items, $r = 0.84$ to 0.99 for the alcohol use items, and $r = 0.60$ to 79 for cholesterol screening).[14] The smoking variable was dichotomized into current smoker versus former smoker and never smoker. Alcohol consumption was assessed two ways: with number of drinks (the average number of drinks in the past month) and problem drinking (participants who reported drinking 5 or more drinks during at least one occasion in the past month *v* those who did not). The physical activity variable was composed of a series of items asking about daily physical activity. Since we could not assume an interval scale between the four categories of physical activity as defined by the American College of Sports Medicine[15-17] (ie, sedentary, irregular, regular, and regular vigorous activity), we dichotomized this variable into two levels: sedentary and irregular activity versus regular activity for at least 20 minutes of mild activity (less than 50% aerobic activity) and regular moderate-to-vigorous activity (ie, at least 20 minutes physical activity at more than 50% aerobic capacity for 3 times a week or more).[16] These categories were defined with the CDC's technical BRFSS scoring monograph which were based on the Public Health Service's 1990 Physical Fitness and Exercise Objectives.[18-20] Fruit and vegetable intake was dichotomized into eating five or more servings of fruits and vegetables per day versus fewer than five (potato chips and french fries were not counted as vegetables). The cholesterol screening variable was dichotomized into checking blood cholesterol within the past year versus longer than 1 year or never.

Analysis

For the comparisons with relative controls, regression models were run controlling for age, education, income, and race. For the matched data with CDC controls, regression models were run controlling for race only. For the cholesterol check model, one additional covariate, whether the participant had been told by a health professional that he had high blood cholesterol, was

Table 2. Prevalences of Health Behaviors

Parameter	Testis Cancer Survivors			Age-Matched Relative Controls			CDC Controls		
	Counts	%	SE	Counts	%	SE	Counts	%	SE
Check cholesterol									
Never/more than 12 months	32	19.8	0.31	23	31.1	0.54	2,314	39.19	0.06
Within past years	73	45.1	0.39	40	54.1	0.58	3,590	60.80	0.06
Missing	57	35.2	0.38	11	14.9	0.41	1,922	—	—
Total	162			74			7,826		
Drinking times/month having > 5 drinks at once									
0	70	43.2	0.39	29	39.2	0.57	5,698	74.56	0.05
1 or more	53	32.7	0.37	23	31.1	0.54	1,944	25.43	0.05
Missing	39	24.1	0.34	22	29.7	0.53	184	—	—
Total	162			74			7,826		
Physical activity									
Physically inactive	30	18.5	0.31	9	12.2	0.38	203	14.00	0.09
Irregular activity	45	27.8	0.35	36	48.7	0.58	453	31.24	0.12
Regular activity	63	38.9	0.38	18	24.3	0.50	540	37.24	0.13
Regular, vigorous activity	24	14.8	0.28	11	14.9	0.41	254	17.51	0.10
Missing	0	0	—	0	0	—	6,376*	—	—
Total	162			74			7,826		
Smoking status									
Current	29	17.9	0.30	12	16.2	0.43	1,454	18.60	0.04
Former	33	20.4	0.32	14	18.9	0.46	1,743	22.30	0.05
Never	99	61.1	0.38	47	63.5	0.56	4,619	59.09	0.06
Refused	0	0	—	0	0	—	10	—	—
Missing	1	0.6	0.06	1	1.4	0.14	—	—	—
Total	162			74			7,826		
Fruits and vegetables									
Less than once/day or never	12	7.4	0.21	4	5.4	0.26	40	4.12	0.06
1 to < 3 times/day	79	48.8	0.39	38	51.4	0.58	382	39.34	0.16
3 to < 5 times/day	52	32.1	0.37	23	31.1	0.54	345	35.53	0.15
5 or more times/day	18	11.1	0.25	9	12.2	0.38	204	21.01	0.13
Refused	0	0	—	0	0	—	6,855*	—	—
Missing	1	0.62		0	0	—	—	—	—
Total	162			74			7826		
Median No. of drinks/month		9			9			6	
Range		243			243			600	
Median No. of drinks/month for drinkers only		17			13			12	
Range		242			242			599	

NOTE. — indicates that the SE is not estimable because of zero cell counts. The missing categories for the CDC data were not included because a missing response reported in the CDC data meant the question was not asked.

Abbreviation: CDC, Centers for Disease Control.

*For the fruit/vegetable and physical activity sections of the CDC data, the sample size is smaller because these sections of the Behavioral Risk Factor Surveillance System were administered to subsamples rather than all 50 states.

added. Not all survivors had an age-matched relative control in the sample and some survivors had more than one matched control. Therefore, we used a logistic mixed-effects model for the dichotomized outcomes (checking cholesterol within the past year, smoking, physical activity, problem drinking episodes, and five or more fruits and vegetables per day) and a two-stage approach using mixed-effects regression models to analyze number of drinks per month to test whether there were statistically significant differences between survivors and controls for each behavior of interest.[21,22] The mixed-effects regression model takes advantage of the shared variability that is inherent in the match between survivor and his age-matched relative controls, and accounts for the unbalanced matching. In these models, a fixed effect indicated survivor status, and a random effect modeled the shared variability from matching the survivor and his controls.

For number of drinks, we first considered whether or not a person drank at all. This was modeled using a logistic regression mixed effects model. Next, conditional on those who drank at least one drink, we fit a mixed-effects regression model to the logarithm of the number of drinks. The log was taken to transform the data so that it followed the necessary normality assumption. Since number of drinks covered a wide range, it was reasonable to assume continuous data.[21,22]

RESULTS

The demographics of the sample are presented in Table 1. The TCS averaged 4.5 years since diagnosis, and 31% had early-stage disease. For the TCS and their relative controls, the mean age was 38.5 and 37.2 years respectively, and 88% of the sample was white non-Hispanic. Just more than one half of the men had completed 4 years of college or more (51% of survivors and 58% of controls). The CDC controls were matched for exact age, education level, and income with the TCS. Regarding race, 85% of the CDC controls were white, and 15% were nonwhite.

Smoking. Nearly one (18%) in five of the TCS reported that they were smoking at the time of the interview (Table 2 for frequencies of all outcomes). After controlling for the demographic variables, survivors were not more likely to be current smokers compared with their matched relative controls (Table 3 for regression results using the relative controls), nor when compared with their CDC controls (Table 4 for regression results using the CDC controls).

Alcohol. Regarding frequency of alcohol use, 75.9% of the TCS reported having had at least one drinking occasion in the past month. Regarding problem drinking, 32.7% of the TCS reported at least one occasion of five or more drinks in the past month. Survivors were not more likely to report problem drinking compared with their matched relative controls (31.1%; Table 2). Similarly, the two-stage regression approach used to analyze the number of drinks showed no significant difference between the age-matched relative controls and the survivors. However, when compared with the CDC controls, the survivors were more likely to engage in problem drinking within the past month (OR, 2.05; Table 4). Regarding the number of drinking occasions, results showed that survivors were not significantly different from the CDC controls in terms of whether they drank, but being a survivor was associated with having more drinks in a month on average (TCS' median of 17 *v* CDC median of 12; Table 2), as evidenced by the positive and statistically significant coefficient given in Table 4 for survivor as a count predictor.

Physical activity. A little more than half of the TCS (54%) engaged in physical activity at least 3 times a week or more. Survivors were twice as likely to engage in regular physical activity compared with their age-matched relative controls (39%; Table 2). But when compared with CDC controls (55%; Table 2), the TCS were not statistically more likely to engage in regular activity ($P = .74$; Table 4).

Fruit and vegetable consumption and cholesterol screening. Just 11% of the TCS reported having at least five servings of fruits and vegetables per day. No difference was found between TCS and their relative-matched controls (12%). Compared with the CDC controls (21%), the survivors were half as likely to have had at least five fruits and vegetables per day (OR, 0.48; Table 4).

No difference was found between TCS' rate of cholesterol screening within the past year (45%) compared with their relative matched controls (54%), nor with their CDC controls (46%; Table 2).

Table 3. Survivors Versus Age-Matched Relative Controls

Outcome Variable	Odds Ratio	Regression Parameter	95% CI	No.
Check cholesterol in past year	1.31		0.66 to 2.62	165
Smoker *v* former/never smoker	0.97		0.24 to 1.70	229
At least one problem drinking episode *v* none	0.89		0.0018 to 1.79	172
Physical activity (dichotomized)	**1.98**		**1.08 to 3.63**	**231**
5 or more fruits and vegetables a day	1.111		0.0277 to 1.77	230
Drink in the past month? (yes/no)	1.41		0.32 to 2.51	235
Log(average number of drinks); restricted to those who drink		0.059	−0.33 to 0.45	174

NOTE: Significant relationships are in bold font. All models controlled for age, education, income, and race. Control was coded as 0 and survivors were coded as 1.

Table 4. Survivors Versus CDC Controls

Outcome Variable	Odds Ratio	Regression Parameter	95% CI	No.
Check cholesterol in past year	1.54		0.88 to 2.21	5,986
Smoker *v* former/never smoker	0.817		0.45 to 1.18	7,945
At least one problem drinking episode versus none	**2.05**		**1.27 to 2.83**	**9,775**
Physical activity (dichotomized)	1.00		0.67 to 1.33	1,601
5 or more fruits and vegetables a day	**0.48**		**0.23 to 0.73**	**1,123**
Drink in the past month? (yes/no)	1.35		0.84 to 1.86	7,461
Log (average number of drinks); restricted to those who drink		0.34	0.12 to 0.56	5,252

NOTE. Significant relationships are in bold font. All models controlled for race. Control was coded as 0 and survivors were coded as 1. For the fruit/vegetable and physical activity sections of the CDC data, the sample size is smaller because these sections of the Behavioral Risk Factor Surveillance System were administered to subsamples rather than all 50 states. For the Log (average number of drinks), a positive regression parameter value indicates a positive relationship between survivors and average number of drinks compared to controls.

Abbreviation: CDC, Centers for Disease Control.

DISCUSSION

We found very little evidence that TCS' cancer experiences afforded a teachable moment resulting in healthier behaviors (Table 5 summary). With the exception of physical activity, TCS were either no

Table 5. Summary of Adjusted Matched Comparisons for Testis Cancer Survivors' Health Behaviors

Variable	Relative Controls	CDC Controls
Smoking	No difference	No difference
Checking cholesterol	No difference	No difference
Problem drinking	No difference	Worse
No. of drinks	No difference	Worse
5 fruits and vegetables	No difference	Worse
Physical activity	Healthier	No difference

Abbreviation: CDC, Centers for Disease Control.

different or reported worse patterns of behaviors compared to their counterparts.

Regarding physical activity, 54% in our sample were engaging in regular exercise of at least moderate intensity and 15% engaged in vigorous physical activity for at least 20 minutes, 3 times per week. This prevalence is lower than Thorsen et al's[10] finding that 43% of 1,276 Norwegian TCS reported engaging in 60 to 120 minutes of hard (or vigorous) physical activity per week on the average. However, it should be noted that Thorsen et al employed a single 4-point item to measure lifestyle physical activity whereas our calculations with the survivors were derived from a structured interview.

The rate of current smoking in our study's survivors (19%) was similar to the range of 17 to 18.6% found in van den Belt-Dusebout's study of 2,512 Dutch 5-year TCS,[23] but lower than those found in Arai et al's[24] (33% to 57%) and Thorsen et al's studies (35.1%[25]; 39.1%[26]). Smoking is generally more prevalent and culturally accepted in Asia and Europe, which may explain our lower rate. Also, our sample was more highly educated than the Norwegian sample,[25] which could have been a factor. Our finding that TCS were not less likely to smoke compared with their two control groups were consistent with other studies: Bellizzi et al[11] found no significant difference between survivors and controls' current smoking. Bloom et al[27] also found that 1-year TCS' smoking rates were similar to the US national men's average.

To our knowledge, this study is the first to report that for those TCS who drink, their average amounts were higher and binge-drinking episodes more frequent compared with population-based controls. Because they were matched on age, education, and income, other unknown factors are driving the differences in alcohol use. At the same time, the TCS were not statistically different than their relative controls, suggesting that familial norms regarding alcohol use were more liberal than those found in the CDC controls. With the exception of Dahl et al's[28] finding that 22% of TCS scored above the cutoff for alcohol problems on a 4-item version of the AUDIT (Alcohol Use Disorders Identification Test), and Bellizzi et al's finding that cancer survivors were not significantly different from their controls, survivors' alcohol use is rarely reported.

On a positive note, survivors were twice as likely to engage in active levels of physical activity compared with their matched relative controls but were not significantly different than the CDC controls. Other studies had mixed results: Eakin et al's population-based case-control study of Australian cancer survivors showed nonsignificant differences in physical activity level,[29] while Thorsen et al's[10] comparison of 1,276 Norwegian TCS with 20,391 age-matched population controls reported the opposite finding.

Our measures of fruit and vegetable consumption were obtained via standardized interview measures, as opposed to gold-standard 24-hour food diaries. Similarly, our measures of alcohol consumption were dependent on self-report, since validation of alcohol levels via biologic assays was not available. Finally, while our measure of physical activity was derived from an interview-based format with our survivors, they should still be considered largely self-report, and therefore subject to bias.

The comparison of our TCS with the CDC controls may result in slightly conservative estimations of differences, due to our inability to separate out cancer survivors from the CDC control data set. Current population estimates of the prevalence of all cancer survivors in the United States are 2% to 3%, so the effect of including TCS in the CDC control group should be negligible (5% prevalence rate of all cancer survivors $\times$ 2.5% = 0.01% affected).

Due to the cross-sectional design, we could not determine the cause of the differences that were uncovered, nor were we able to analyze whether TCS' physical activity levels changed after cancer. However, the fact that these differences existed between the population sample and the survivors but not the survivors and their age-matched relative controls identifies a potential area for further study. It is also possible that the testis cancer experience affected both the survivors and their relatives.

While the health behavior comparisons were not consistently worse for our TCS compared with the two types of controls, the overall picture does not support a teachable moment scenario for TCS (Table 5). Instead, they were mostly very similar to their relative controls and worse than their CDC controls with regard to alcohol use. This higher risk of problem drinking is concerning in light of TCS' higher risk for solid tumors in the kidney, lung, stomach, pancreas, and esophagus.[3] They also were less likely to have five daily servings of fruits and vegetables compared with the population-based controls. These findings are important for those clinicians who participate in long-term TCS follow-up, suggesting that both binge-drinking and fruit and vegetable intake are important areas to address in reducing risks of cardiovascular disease and second primaries in TCS.

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Although all authors completed the disclosure declaration, the following author(s) indicated a financial or other interest that is relevant to the subject matter under consideration in this article. Certain relationships marked with a "U" are those for which no compensation was received; those relationships marked with a "C" were compensated. For a detailed description of the disclosure categories, or for more information about ASCO's conflict of interest policy, please refer to the Author Disclosure Declaration and the Disclosures of Potential Conflicts of Interest section in Information for Contributors.

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REFERENCES

1. Society AC: Cancer Facts & Figures 2004. Atlanta, GA, American Cancer Society Inc, 2004

2. Bajorin D: The graying of testis cancer patients: What have we learned? J Clin Oncol 25:4341-4343, 2007

3. Travis L, Curtis R, Storm H, et al: Risk of second malignant neoplasms among long-term survivors of testicular cancer. J Natl Cancer Inst 89: 1429-1439, 1997

4. Huddart RA, Norman A, Shahidi M, et al: Cardiovascular disease as a long-term complication of treatment for testicular cancer. J Clin Oncol 21:1513-1523, 2003

5. Meinardi M, Gietema J, van der Graaf W, et al: Cardiovascular morbidity in long-term survivors of metastatic testicular cancer. J Clin Oncol 18:1725-1732, 2000

6. Austoker J: Cancer prevention in primary care: Cancer prevention: Setting the scene. BMJ 308:1415-1420, 1994

7. Byers T, Anda R, McQueen D, et al: The correspondence between coronary heart disease mortality and risk factor prevalence among states in the United States, 1991-1992. Prev Med 27:311-316, 1998

8. Blanchard C, Denniston M, Baker F, et al: Do adults change their lifestyle behaviors after a cancer diagnosis? American Journal of Health Behaviors 27:245-256, 2003

9. Tangney C, Young J, Murtaugh M, et al: Self-reported dietary habits, overall dietary quality and symptomatology of breast cancer survivors: A cross-sectional examination. Breast Cancer Res and Treatment 71:113-123, 2002

10. Thorsen L, Nystad W, Dahl O, et al: The level of physical activity in long-term survivors of testicular cancer. Eur J Cancer 39:1216-1221, 2003

11. Bellizzi K, Rowland J, Jeffery D, et al: Health behaviors of cancer survivors: Examining opportunities for cancer control intervention. J Clin Oncol 23:8884-8893, 2005

12. Hao D, Seidel J, Brant R, et al: Compliance of clinical stage I nonseminomatous germ cell tumor patients with surveillance. J Urol 160:768-771, 1998

13. Shinn E, Basen-Engquist K, Thornton B, et al: Health behaviors and depressive symptoms in testis cancer survivors. Urology 69:548-553, 2007

14. Nelson D, Holtzman D, Bolen J, et al: Reliability and validity of measures from the Behavioral Risk Factor Surveillance System (BRFSS). Soz Praventivmed 46:S32-S42, 2001 (suppl 1)

15. Pate RR, Pratt M, Blair SN, et al: Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA 273:402-407, 1995

16. Medicine ACoS: The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness in healthy adults. Medicine and Science in Sports and Exercise 22:265-274, 1990

17. Medicine ACoS: Position Statement on the recommended quantity and quality of exercise for developing and maintaining fitness in healthy adults. Medicine and Science in Sports and Exercise 10: vii-x, 1978

18. Casperson C, Powell K: A Computerized Scoring System for the Physical Activity Questions of the Behavioral Risk Factor Surveillance System. Atlanta, GA, Center for Health Promotion and Education, Centers for Disease Control, 1986, pp 1-31

19. Casperson C: Behavioral risk factor surveillance system. Med Sci Sports Exerc 29:146-152, 1997 (suppl)

20. Casperson C, Christenson G, Pollard R: Status of the 1990 physical fitness and exercise objectives: Evidence from NHIS 1985. Public Health Rep 101: 587-592, 1986

21. Neter J: Applied Linear Statistical Models (ed 4). Chicago, IL, Irwin, 1996

22. Hall D: Zero-inflated Poisson and binomial regression with random effects: A case study. Biometrics 56:1030-1039, 2000

23. van Den Belt-Dusebout A, Nuver J, de Wit R, et al: Long-term risk of cardiovascular disease in 5-yr survivors of testicular cancer. J Clin Oncol 24:467-475, 2005

24. Arai Y, Mutsushi K, Hida S, et al: Psychosocial aspects in long-term survivors of testicular cancer. J Urol 155:574-578, 1996

25. Sagstuen H, Aass N, Fossa S, et al: Blood pressure and body mass index in long-term survivors of testicular cancer. J Clin Oncol 23:4980-4990, 2005

26. Thorsen L, Nystad W, Stigum H, et al: The association between self-reported physical activity and prevalence of depression and anxiety disorder in long-term survivors of testicular cancer and men in a general population sample. Support Care Cancer 13:637-646, 2005

27. Bloom J, Fobair P, Gritz E, et al: Psychosocial outcomes of cancer: A comparative analysis of Hodgkins disease and testicular cancer. J Clin Oncol 11:979-988, 1993

28. Dahl A, Haaland C, Mykletun A, et al: Study of anxiety disorder and depression in long-term survivors of testicular cancer. J Clin Oncol 23:2389-2395, 2005

29. Eakin E, Youlden D, Baade P, et al: Health status of long-term cancer survivors: Results from an Australian population-based sample. Cancer Epidemiological and Biomarker in Prevention 15:1969-1976, 2006