

Cancer Survivors in the United States: Age, Health, and Disability

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Background. Relatively little is known about the health and disability of adult cancer survivors. As a way to explore these issues, data from the National Health Interview Survey (years 1998–2000) were analyzed.

Methods. Comparisons were made between cancer survivors ($n = 4878$) and those without a history of cancer ($n = 90,737$), using both descriptive statistics and logistic-regression models on general health status, psychological disability, limitations in activities of daily living, physical function, and health-related ability to work. Among cancer survivors, health and disability status were assessed by cancer site or type, age at diagnosis, and years since cancer diagnosis.

Results. Compared with individuals without a history of cancer or other chronic disease, cancer survivors without other chronic diseases were significantly more likely to report being in fair or poor health (odds ratio, or OR, 2.97), a psychological disability (OR 2.18), limitations of activities of daily living or instrumental activities of daily living (OR 2.22), functional limitations (OR 1.74), and, among those under the age of 65, being unable to work because of a health condition (OR 3.22). The likelihood of poor health and disability was much higher among cancer survivors who also reported comorbid chronic conditions.

Conclusions. Providers caring for cancer survivors should be made aware of the long-term health consequences of cancer and consider appropriate supportive care for their patients. The identification of long-term effects of cancer that contribute to disability and the interventions needed to ameliorate these and their consequences should become a more prominent aspect of the research agenda.

RECENT estimates indicate that 8.9 million Americans have a history of cancer (1) (<http://dcccps.nci.nih.gov/ocs/>). This number is expected to increase as the U.S. population ages and with continued improvements in early detection and treatment of cancer (2,3). The proportion of the population aged 65 years or older who are cancer survivors is already substantial; it is estimated at 16% as of 1997 (<http://srab.cancer.gov/prevalence/index.html>).

Cancer survival may be associated with short- and long-term morbidity secondary to the effects of cancer and its treatment. Survivors of breast cancer, for example, may experience chronic lymphedema, sexual dysfunction, and cognitive impairment (4–11). Survivors of malignancies of the lung, prostate, and colon may have medical, psychosocial, and sexual problems (12–14). Psychosocial problems among cancer survivors are common and may include fear of recurrence and death, anxiety and depression, feelings of alienation or isolation, problems with interpersonal relationships, and economic hardships related to the cost of care, job loss, and employment and insurance discrimination (15,16). Concern for the associated threats to function and well-being of cancer survivors has prompted investigators to focus on issues related to quality of life following cancer treatment. Although cancer is increasingly viewed as a chronic illness and there are now greater numbers of survivors, relatively little is known about their health and disability status.

This paper characterizes a population-based sample of adults reporting a history of cancer in terms of their socio-demographic and health characteristics. Three questions are

then addressed: first, is a history of cancer a risk factor for poor health and disability? Second, among cancer survivors, what characteristics are associated with poor health and disability? Third, are reports of poor health and disability among cancer survivors associated with greater use of supportive care services?

METHODS

Data Source

The National Health Interview Survey (NHIS) is conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention, and it is the principal source of information on the health of the civilian, noninstitutionalized, household population of the United States (17). Estimates of cancer prevalence and information on adult (aged 18 and older) cancer survivors are available from the NHIS because the “sample adult” component of the survey asks, “Have you ever been told by a doctor or other health professional that you had cancer or a malignancy of any kind?” If the respondents report a history of cancer, they are asked the site of the cancer (the interviewer asked about 30 possible cancer sites) and the age when they were first diagnosed with that type of cancer (up to three cancer sites/types could be reported). In these analyses, except where specified, superficial skin cancers reported are excluded.

For a sufficient sample for analyses by cancer type to be obtained, 3 years (1998–2000) of survey data are combined.

Table 1. Number and Distribution of Adults With Self-Reported History of Cancer by Sociodemographic and Health Characteristics

Characteristic	Self-Reported Cancer History			No Reported Cancer History		
	Sample Size	Est. No. (in 1000s)	% Distribution (SE)	Sample Size	Est. No. (in 1000s)	% Distribution (SE)
Total	4,878	28,850	100.0	90,737	569,769	100.0
Age at interview (y)						
18–44	855	5,450	18.9 (0.6)	48,417	319,942	56.2 (0.3)
45–64	1,473	9,301	32.2 (0.8)	26,354	166,534	29.2 (0.2)
65–74	1,202	6,845	23.7 (0.7)	8,601	46,840	8.2 (0.1)
75+	1,348	7,254	25.1 (0.7)	7,365	36,453	6.4 (0.1)
Sex						
Male	1,624	10,676	37.0 (0.8)	39,766	276,213	48.5 (0.2)
Female	3,254	18,175	63.0 (0.8)	50,971	293,555	51.5 (0.2)
Race/ethnicity						
White, non-Hispanic	4,004	25,127	87.1 (0.5)	59,727	420,838	73.9 (0.3)
White, Hispanic	330	1,227	4.3 (0.3)	15,226	60,514	10.6 (0.2)
Black	456	1,965	6.8 (0.4)	12,675	65,366	11.5 (0.3)
Other	88	532	1.8 (0.2)	3,109	23,051	4.0 (0.1)
Education*	4,749	27,946	100.0	80,065	487,698	100.0
<HS	1,185	6,373	22.8 (0.7)	16,663	84,060	17.2 (0.2)
High school or GED	1,492	9,056	32.4 (0.8)	23,474	148,119	30.4 (0.3)
>HS	2,072	12,517	44.8 (0.9)	39,928	255,519	52.4 (0.3)
Health insurance†	4,870	28,792	100.0	90,362	567,379	100.0
Covered	4,546	26,839	93.2 (0.4)	75,419	480,527	84.7 (0.2)
Not covered	324	1,953	6.8 (0.4)	14,943	86,852	15.3 (0.2)
Marital status‡	4,871	28,825	100.0	90,268	567,876	100.0
Never married	399	1,867	6.5 (0.4)	18,990	109,909	19.4 (0.2)
Married	2,470	18,777	65.1 (0.7)	48,216	364,625	64.2 (0.3)
Divorced, widowed, separated	2,002	8,181	28.4 (0.6)	23,062	93,342	16.4 (0.2)
No. of chronic med. conditions§						
0	2,744	16,717	57.9 (0.8)	71,596	457,660	80.3 (0.2)
1	1,484	8,477	29.4 (0.7)	14,889	88,351	15.5 (0.2)
2	477	2,726	9.4 (0.5)	3,352	18,890	3.3 (0.1)
3+	173	931	3.2 (0.3)	900	4,868	0.9 (0.0)

Notes: Adults are aged ≥ 18 y; cancer excludes superficial skin cancer. Data are from the National Health Interview Survey, 1998–2000. SE = standard error.

*Limited to age 25 and older, an age when most would have completed their education.

†Those without health insurance coverage are persons who did not report having health care coverage at the time of the interview under private health insurance, Medicare, Medicaid, public assistance, a state-sponsored health plan, other government programs, or military health plan.

‡Those reporting that they were living with a partner were categorized as married.

§Number reported includes reports of respondents ever being told by a physician or health professional that they had cardiovascular disease, diabetes (currently treated), emphysema, asthma (symptomatic in last 12 mo) or told in that last 12 mo that they had an ulcer, weak/failing kidneys, or a liver condition (see Appendix for details).

A total of 4878 of the 95,615 sample adults who were questioned reported a history of cancer. NHIS data are collected through personal interviews conducted in the home. Response rates for the sample adult component of the NHIS in 1998, 1999, and 2000 were 74%, 70%, and 72%, respectively (17–19).

In these analyses, cancer survivors include respondents who reported ever having a diagnosis of cancer, regardless of whether or not they had symptoms of cancer at the time of the survey. The current cancer status (i.e., active disease or remission) was not ascertained in the interview. Disability refers to physical or mental limitations in a social context, that is, the gap between a person's capabilities and the demands of his or her environment (20). This study assesses disabilities related to psychological problems, limitations in activities in daily living (ADL), instrumental activities of daily living (IADL), functional limitations, and any health-related limitations in the ability to work. NHIS questions used to determine health and disability status are indicated in the Appendix.

Statistical Analyses

Descriptive statistics and logistic-regression models are presented to indicate whether cancer survivors, compared with individuals without a self-reported history of cancer, have higher reported rates of fair or poor health or disability, if sociodemographic characteristics and the presence of comorbid conditions are controlled for. Descriptive statistics and logistic-regression models are also presented to identify cancer-specific characteristics associated with poor health and disability (i.e., site or type of cancer, age at diagnosis, and years since diagnosis). The data collected in the NHIS are obtained through a complex sample design involving stratification, clustering, and multistage sampling. All proportions and population counts presented are weighted to provide national estimates. Variance estimates for proportions and logistic-regression model odds ratios (ORs) were calculated by use of the Taylor series approximation technique, taking into account the complex design of the survey (21). All *p* values are two sided; if less than .05, they are considered statistically significant.

RESULTS

Cancer Prevalence and Characteristics of Cancer Survivors

In the 3-year study period there were 28.8 million adult survivors of cancer (an annual average of 9.6 million), representing 4.8% of the adult population (Table 1). Respondents identified as cancer survivors, as compared with those with no history of cancer, were significantly older (48.8% vs 14.6% aged 65 and older), more likely to be female (63.0% vs 51.5%), and non-Hispanic white (87.1% vs 73.9%). Perhaps because of their older age distribution, cancer survivors were more likely than others to have other chronic medical conditions (42.1% vs 19.7% reporting one or more conditions), have lower educational attainment (22.8% vs 17.2% with less than a high school education), be currently or formerly married (93.5% vs 80.7%), and have health insurance coverage (93.2% vs 84.8%; Table 1).

A large proportion of cancer survivors were women with a history of cancers of the cervix, uterus, or ovary (21.3%) or breast cancer (21.0%; Table 2). The majority of individuals with a history of cancer were diagnosed before the age of 65 (35.7% under the age of 45 years and 35.1% from the age of 45 to 65 years). A near equal share of survivors reported having been diagnosed within 2 years of the interview (16.8%) and 20 or more years before the interview (15.1%; Table 2).

Is a History of Cancer a Risk Factor for Poor Health and Disability?

According to bivariate analyses, cancer survivors were significantly more likely than others to report being in fair or poor health (29.8% vs 10.5%), to have three or more other chronic medical conditions (3.2% vs 0.9%), psychological problems (5.4% vs 2.8%), one or more limitations of ADL or IADL (11.3% vs 3.2%), one or more functional limitations (58.1% vs 28.5%), and among those under the age of 65, to be unable to work because of their health (16.8% vs 5.0%; Table 3). Significantly higher levels of self-reported poor health status and disability were observed in each of the three age groups assessed (18–44, 45–64, and 65 and older). One third (33.9%, standard error 1.3) of the individuals with a history of cancer reporting ADL or IADL or certain functional limitations mentioned cancer as a cause of their limitations.

Multivariate logistic regression models that controlled for differences in selected sociodemographic and health characteristics confirm the greater likelihood of poor health and disability among those reporting a history of cancer. Individuals reporting no chronic illness, either cancer or other chronic illnesses, were compared with two groups of cancer survivors, those with and without other chronic illness. Cancer survivors as compared with those without cancer or other chronic illness were significantly more likely to report being in fair or poor health (OR 2.97 and 10.03, respectively for those with only cancer and those with cancer in addition to other chronic illness), to have disabling psychological problems (OR 2.18 and 5.91, respectively), to have one or more limitations in ADL or IADL (OR 2.22 and 6.20, respectively), to have one or more functional

Table 2. Number and Distribution of Adults With Self-Reported History of Cancer by Cancer-Related Characteristics

Characteristic	Sample size	Est. No.	
		(in 1000s)	(SE) % Total (SE)
Total	4,878	28,850 (526)	100.0
Site or Type of Cancer by Sex*			
Breast	1,079	6,070 (209)	21.0 (0.6)
Cervix	562	3,272 (158)	11.3 (0.5)
Prostate	559	3,530 (159)	12.2 (0.5)
Colon, rectum	494	2,802 (146)	9.7 (0.5)
Male	213	1,384 (111)	4.8 (0.4)
Female	281	1,418 (102)	4.9 (0.3)
Uterus	376	2,034 (117)	7.0 (0.4)
Melanoma	298	2,012 (134)	7.0 (0.4)
Male	143	1,073 (101)	3.7 (0.3)
Female	155	939 (87)	3.3 (0.3)
Larynx, lung, pharynx	223	1,386 (105)	4.8 (0.4)
Male	127	823 (81)	2.8 (0.3)
Female	96	564 (69)	2.0 (0.2)
Leukemia, lymphoma	222	1,400 (104)	4.8 (0.3)
Male	94	665 (80)	2.3 (0.3)
Female	128	735 (76)	2.5 (0.3)
Ovary	168	872 (75)	3.0 (0.3)
Other	897	5,472 (198)	19.0 (0.6)
Male	488	3,201 (148)	11.1 (0.5)
Female	409	2,271 (131)	7.9 (0.4)
Age at diagnosis (y)			
Total	4,844		
<45	1,673	10,251 (288)	35.7 (0.8)
45–64	1,655	10,061 (282)	35.1 (0.8)
65+	1,516	8,363 (283)	29.2 (0.7)
Age at interview, at diagnosis (y)			
Total	4,844		
18–44, <44	851	5,414 (211)	18.9 (0.6)
45–64, <44	639	3,864 (163)	13.5 (0.5)
45–64, 45–64	827	5,405 (203)	18.8 (0.6)
65+, <44	183	973 (87)	3.4 (0.3)
65+, 45–64	828	4,656 (193)	16.2 (0.6)
65+, 65+	1,516	8,363 (273)	29.2 (0.7)
Years since diagnosis [†]			
Total	4,844		
<2	808	4,822 (209)	16.8 (0.6)
2–4	1,075	6,494 (233)	22.6 (0.7)
5–9	1,088	6,414 (214)	22.4 (0.7)
10–19	1,095	6,617 (243)	23.1 (0.7)
20+	778	4,328 (173)	15.1 (0.5)

Notes: Adults are aged ≥ 18 y; cancer excludes superficial skin cancer. Data are from the National Health Interview Survey, 1998–2000. SE = standard error.

*573 respondents reported more than one cancer (including superficial skin cancer). When more than one cancer had been diagnosed, site/type was categorized as the first diagnosed (excluding superficial skin cancer).

[†]The number of years since diagnosis was calculated from the reported age at interview and age at first diagnosis. When more than one cancer was reported, years since the first diagnosis (excluding superficial skin cancer) were used to calculate years since diagnosis. In a few instances, a correction was made for respondents who provided years since diagnosis instead of age at diagnosis.

limitations (OR 1.74 and 5.06, respectively), and among those aged 65 and younger, to be unable to work because of their health (OR 3.22 and 11.80, respectively; Table 4).

Among Cancer Survivors, What Characteristics Are Associated With Poor Health and Disability?

According to bivariate analyses, relative to women with a history of breast cancer, individuals with a history of lung

Table 3. Health Status and Prevalence of Disability of Adults by Self-Reported History of Cancer

Characteristic*	Self-Reported Cancer Hist. (% SE)				No Reported Cancer Hist. (% SE)			
	All	Age (y)			All	Age (y)		
		18-44	45-64	65+		18-44	45-64	65+
Gen. health status								
Excellent, very good	37.1 (0.8)	47.2 (2.1)	42.1 (1.5)	29.8 (1.1)	65.7 (0.2)	75.3 (0.3)	59.5 (0.4)	41.2 (0.5)
Good	33.1 (0.8)	34.4 (2.0)	28.1 (1.2)	35.9 (1.0)	23.8 (0.2)	19.5 (0.2)	26.7 (0.3)	34.6 (0.4)
Fair, poor	29.8 (0.8)	18.4 (1.6)	29.8 (1.3)	34.2 (1.1)	10.5 (0.1)	5.2 (0.1)	13.8 (0.3)	24.2 (0.4)
No. of other chronic med. cond.								
0	57.9 (0.8)	72.8 (1.6)	64.3 (1.3)	48.0 (1.2)	80.3 (0.2)	89.0 (0.2)	75.9 (0.3)	56.0 (0.5)
1	29.4 (0.7)	20.5 (1.5)	24.6 (1.3)	36.0 (1.1)	15.5 (0.2)	9.7 (0.2)	18.5 (0.3)	32.0 (0.4)
2	9.4 (0.5)	5.1 (0.9)	7.9 (0.8)	12.1 (0.7)	3.3 (0.1)	1.1 (0.1)	4.3 (0.2)	9.7 (0.3)
3+	3.2 (0.3)	1.5 (0.5)	3.1 (0.5)	3.9 (0.4)	0.9 (0.0)	0.2 (0.0)	1.3 (0.1)	2.3 (0.1)
Psychol. problems								
Yes	5.4 (0.4)	9.2 (1.2)	6.1 (0.7)	3.6 (0.4)	2.8 (0.1)	2.8 (0.1)	3.1 (0.1)	2.5 (0.2)
No	94.6 (0.4)	90.8 (1.2)	93.9 (0.7)	96.4 (0.4)	97.2 (0.1)	97.2 (0.1)	96.9 (0.1)	97.5 (0.2)
1+ ADL/IADL								
Yes	11.3 (0.5)	3.8 (0.7)	7.0 (0.7)	17.0 (0.8)	3.2 (0.1)	1.0 (0.1)	3.2 (0.1)	11.8 (0.3)
No	88.7 (0.5)	96.2 (0.7)	93.0 (0.7)	83.0 (0.8)	96.8 (0.1)	99.0 (0.1)	96.8 (0.1)	88.2 (0.3)
1+ functional limits								
Yes	58.1 (0.9)	38.6 (2.0)	53.2 (1.5)	68.9 (1.0)	28.5 (0.2)	16.9 (0.2)	34.8 (0.4)	60.7 (0.5)
No	41.9 (0.9)	61.4 (2.0)	46.8 (1.5)	31.1 (1.0)	71.5 (0.2)	83.1 (0.2)	65.2 (0.4)	39.3 (0.5)
Work limits (health related)[†]								
None	75.8 (1.0)	82.5 (1.5)	71.9 (1.3)	NA	91.8 (0.2)	94.7 (0.1)	86.1 (0.3)	NA
Limited	7.4 (0.6)	5.9 (0.9)	8.3 (0.8)	NA	3.2 (0.1)	2.5 (0.1)	4.8 (0.2)	NA
Unable to work	16.8 (0.9)	11.6 (1.3)	19.8 (1.2)	NA	5.0 (0.1)	2.8 (0.1)	9.1 (0.2)	NA

Notes: Adults are aged ≥ 18 y; cancer excludes superficial skin cancer. Data are from the National Health Interview Survey, 1998–2000. For self-reported history, $n = 4878$; for no reported history, $n = 90,737$. NA = not applicable; ADL = activities of daily living; IADL = instrumental ADL. SE = standard error.

*See Appendix for definition of health and disability measures.

[†]Results shown are for those under the age of 65 y.

and respiratory cancer were more likely to be in fair or poor health, and women with a history of cervical cancer were more likely to report psychological problems (Table 5). According to multivariate analyses, relative to women with a history of breast cancer, individuals with a history of lung or respiratory cancers, and leukemia or lymphoma reported poorer health status. Men with a history of lung or respiratory cancers were more likely to report psychological problems. Men with a history of colorectal cancer and men with a history of melanoma were less likely to report having limitations in ADL or IADL. Men with a history of prostate cancer were less likely to report functional limitations. Men with “other” cancers were more likely to report inability to work because of their health (Table 6).

Relationships between sociodemographic and health characteristics and disability appeared to be similar among cancer survivors and the entire population. Younger individuals diagnosed before the age of 45, for example, were at highest risk of psychological problems (OR 2.36 relative to those aged 65 and older and diagnosed after the age of 65). Higher educational attainment was generally associated with better health and lower levels of disability, whereas an increased number of comorbid conditions was consistently associated with poorer health and higher levels of disability (Table 6).

In all age groups, cancer survivors reported significantly higher rates of chronic illness (Table 7). The prevalence of cardiovascular disease is especially high (e.g., 10.6% vs 4.4% among those aged 18–44). There is a higher pre-

valence of current or former smokers among cancer survivors as compared with those without a history of cancer (57.6% vs 45.7%).

Are Reports of Poor Health and Disability Among Cancer Survivors Associated With Greater Use of Supportive Care Services?

Physician specialists were consulted by cancer survivors in the past year at more than double the rate of those without a history of cancer (59.7% vs 23.1%; Table 8). The use of physical therapy, occupational therapy, speech therapy, respiratory therapy, or audiology services was significantly greater among cancer survivors than among those without a history of cancer (12.8% vs 6.7%). Use of these services was even greater among cancer survivors reporting functional limitations (18.2%). More than one third (34.6%) of cancer survivors reporting psychological problems had seen a mental health professional in the past year. Among cancer survivors unable to work because of their health, 19.5% had received Supplemental Security Income (SSI) disability benefits from the Social Security Administration (Table 8).

DISCUSSION

Our analyses indicate that a medical history of cancer at least doubles an individual's likelihood of poor health and disability. When a cancer history is coupled with the occurrence of another chronic illness, the likelihood of poor health and disability is approximately 5–10 times higher than would be expected. This excess morbidity may reflect

Table 4. ORs and 95% CIs for the Model Identifying Characteristics Associated With Health and Disability Status Among Adults

Characteristic	Fair/poor Self-Rep. Health Status	Psychol. Problems	≥1 ADL/IADL	≥1 Functional Limit	Unable to Work*
History of cancer/other chronic disease [†]					
No cancer, no other disease	—	—	—	—	—
Cancer, no other disease	2.97 (2.60–3.38)	2.18 (1.67–2.84)	2.22 (1.83–2.71)	1.74 (1.58–1.91)	3.22 (2.63–3.93)
No cancer, other disease(s)	6.04 (5.74–6.37)	3.80 (3.43–4.21)	4.57 (4.18–5.01)	3.41 (3.26–3.56)	5.82 (5.39–6.28)
Cancer, other disease(s)	10.03 (8.93–11.27)	5.91 (4.85–7.21)	6.20 (5.32–7.22)	5.06 (4.47–5.72)	11.80 (9.70–14.37)
Age at interview (y)					
18–44	—	—	—	—	—
45–64	2.30 (2.15–2.47)	0.85 (0.77–0.93)	2.55 (2.22–2.92)	2.12 (2.02–2.21)	2.50 (2.30–2.71)
65–74	2.43 (2.22–2.66)	0.41 (0.34–0.48)	3.16 (2.68–3.73)	3.41 (3.19–3.64)	NA
75+	2.65 (2.39–2.94)	0.33 (0.26–0.41)	8.13 (6.98–9.46)	5.78 (5.37–6.22)	NA
Sex					
Male	0.97 (0.92–1.02)	0.71 (0.65–0.78)	0.72 (0.66–0.78)	0.65 (0.62–0.67)	1.14 (1.06–1.24)
Female	—	—	—	—	—
Race/ethnicity					
White, non-Hispanic	—	—	—	—	—
White, Hispanic	1.31 (1.19–1.44)	0.92 (0.81–1.06)	0.95 (0.84–1.07)	0.62 (0.58–0.66)	0.76 (0.66–0.87)
Black	1.84 (1.71–1.98)	0.87 (0.77–1.00)	1.30 (1.16–1.45)	0.88 (0.83–0.93)	1.32 (1.18–1.47)
Other	1.29 (1.12–1.48)	0.90 (0.70–1.16)	0.96 (0.72–1.28)	0.68 (0.60–0.76)	0.87 (0.67–1.12)
Education					
< High school	2.07 (1.93–2.21)	1.48 (1.31–1.67)	1.52 (1.39–1.67)	1.38 (1.30–1.45)	2.10 (1.89–2.33)
High school or equivalent	—	—	—	—	—
> High school	0.55 (0.52–0.58)	0.65 (0.58–0.72)	0.76 (0.69–0.85)	0.82 (0.79–0.86)	0.51 (0.47–0.56)
Health insurance [‡]					
Covered	—	—	—	—	—
Not covered	1.24 (1.14–1.34)	1.39 (1.23–1.58)	0.61 (0.50–0.73)	1.00 (0.95–1.06)	0.65 (0.58–0.73)
Marital status [§]					
Never married	1.03 (0.95–1.12)	1.54 (1.36–1.73)	2.19 (1.88–2.54)	0.90 (0.85–0.96)	1.78 (1.59–1.99)
Married	—	—	—	—	—
Divorced, widowed, separated	1.32 (1.25–1.41)	2.09 (1.88–2.32)	2.26 (2.06–2.48)	1.28 (1.23–1.33)	2.32 (2.12–2.53)

Notes: The Model is the multivariate logistic model; adults are aged ≥18 y. Data are from the National Health Interview Survey, 1998–2000. OR = odds ratio; CI = confidence interval; NA = not applicable. Dashes signify reference categories. ADL = activities of daily living; IADL = instrumental ADL.

*Results are shown for those under the age of 65 y.

[†]Chronic medical conditions reported by respondents ever being told by a physician or health professional that they had cardiovascular disease, diabetes (currently treated), emphysema, asthma (symptomatic in last 12 mo) or told in the last 12 mo that they had an ulcer, weak/failing kidneys, or a liver condition (see Appendix for details).

[‡]Those without health insurance coverage are persons who did not report having health care coverage at the time of the interview under private health insurance, Medicare, Medicaid, public assistance, a state-sponsored health plan, other government programs, or military health plan.

[§]Those reporting that they were living with a partner were categorized as married.

persistence of late effects of cancer and its treatment and the consequences of underlying risk factors for cancer. Smoking behavior, for example, contributes significantly to heart disease, respiratory illness, and other ailments, and the higher prevalence of a history of smoking among cancer survivors could, in part, explain poorer health and disability.

The high prevalence of comorbid chronic illness and disability among cancer survivors is a striking finding with implications for health care. Nearly one half of cancer survivors are aged 65 and older. They may have preexisting chronic diseases and functional limitations at the time of their cancer diagnosis, but the higher prevalence of chronic illness among cancer survivors relative to others may be a consequence of the late effects of cancer and its treatment. It is likely that the emerging chronic disease model of care (22,23) will be applicable to all cancer survivors, because even among younger cancer survivors, rates of cardiovascular disease, functional limitations, and work limitations are quite high. The chronic disease model posits that through more productive interactions between patients and provider teams, functional and clinical outcomes can be

improved. The model calls for improvements in coordinated delivery systems, including connecting health systems with community resources to support patients in a meaningful way (www.Improvingchroniccare.org).

Cancer is primarily a disease of the elderly population, and it is expected that the aging of the U.S. population will increase the number of older persons vulnerable to cancer. Barring any major prevention and treatment breakthroughs in the next three decades, as the proportion of persons aged 65 years and older expands, greater numbers of individuals diagnosed with cancer are anticipated (2,3). Accordingly, there will be an increase of older cancer survivors. Primary care physicians, geriatricians, and oncologists caring for individuals with a history of cancer should be made aware of the excess of morbidity associated with cancer and consider the appropriateness of supportive care services for survivors. Referrals to rehabilitative and mental health services could assist in ameliorating symptoms and improve function (24–27). Disability among cancer survivors appears to be most pronounced in the area of physical functioning. With nearly one in six (16.8%) working-age

Table 5. Health and Disability Status Among Adults With a Self-Reported History of Cancer by Cancer-Related Characteristics

Characteristic	Fair/Poor Self-Rep. Health Status	Psychol. Problems	≥1 ADL/IADL	≥1 Functional Limit	Unable to Work*
Total	29.8 (0.8)	5.4 (0.4)	11.3 (0.5)	58.1 (0.9)	16.8 (0.9)
Site or Type of Cancer by Sex [†]					
Breast	28.5 (1.6)	3.6 (0.6)	12.9 (1.0)	60.3 (1.6)	15.0 (2.0)
Cervix	22.6 (1.9)	9.3 (1.3)	7.1 (1.1)	47.0 (2.4)	11.1 (1.5)
Prostate	30.3 (2.2)	3.5 (0.8)	10.0 (1.5)	56.5 (2.3)	18.0 (4.3)
Colon, rectum	30.9 (2.4)	4.0 (1.0)	12.1 (1.6)	64.4 (2.5)	19.1 (3.9)
Male	30.2 (3.6)	—	9.3 (2.1)	59.7 (3.8)	—
Female	31.5 (3.1)	—	14.7 (2.1)	69.0 (3.3)	—
Uterus	31.1 (2.6)	6.1 (1.2)	13.5 (1.7)	65.9 (2.9)	23.8 (3.1)
Melanoma	22.1 (2.5)	5.2 (1.7)	6.1 (1.4)	50.8 (3.5)	8.6 (2.3)
Male	20.4 (3.5)	—	—	48.9 (4.7)	—
Female	24.1 (4.0)	—	—	52.9 (4.9)	—
Larynx, lung, pharynx	47.8 (4.0)	9.2 (2.6)	15.9 (2.8)	65.6 (3.7)	26.8 (4.8)
Male	47.9 (5.4)	—	—	62.7 (5.2)	—
Female	47.7 (5.7)	—	—	69.7 (5.6)	—
Leukemia, lymphoma	36.4 (4.0)	6.2 (1.7)	12.3 (2.1)	60.9 (3.9)	23.3 (4.6)
Male	40.0 (6.3)	—	—	58.0 (6.2)	—
Female	33.2 (4.6)	—	—	63.6 (5.0)	—
Ovary	29.1 (3.8)	9.0 (2.4)	14.4 (2.9)	60.2 (4.4)	17.9 (4.3)
Other	31.0 (1.8)	5.4 (0.9)	11.4 (1.2)	57.0 (1.9)	18.8 (2.0)
Male	31.8 (2.5)	4.8 (1.0)	9.7 (1.4)	53.1 (2.4)	20.3 (2.8)
Female	29.8 (2.5)	6.2 (1.4)	13.7 (2.0)	62.5 (2.9)	17.0 (2.7)
Age at diagnosis (y)					
<45	23.7 (1.2)	8.0 (0.8)	6.2 (0.6)	47.8 (1.5)	14.8 (1.0)
45–64	29.5 (1.4)	3.5 (0.5)	9.3 (0.7)	58.2 (1.4)	20.1 (1.5)
65+	37.0 (1.4)	4.3 (0.5)	19.3 (1.2)	70.3 (1.3)	NA
Age at interview, at diagnosis (y)					
18–44, <44	17.9 (1.6)	8.8 (1.1)	3.6 (0.7)	38.2 (2.0)	11.5 (1.3)
45–64, <44	27.1 (1.8)	8.2 (1.2)	8.2 (1.1)	55.2 (2.2)	19.3 (1.8)
45–64, 45–64	31.6 (1.9)	4.5 (0.7)	6.0 (0.9)	51.7 (1.9)	20.1 (1.5)
65+, <44	42.1 (3.9)	—	12.9 (2.6)	71.5 (3.5)	NA
65+, 45–64	27.1 (1.8)	—	13.2 (1.2)	65.8 (1.9)	NA
65+, 65+	37.0 (1.4)	4.3 (0.5)	19.3 (1.2)	70.3 (1.3)	NA
Years since diagnosis [‡]					
<2	35.9 (1.8)	6.3 (1.0)	12.5 (1.1)	60.3 (2.1)	18.5 (2.1)
2–4	30.5 (1.7)	4.8 (0.7)	9.3 (1.0)	52.6 (1.7)	15.7 (1.8)
5–9	26.7 (1.5)	4.0 (0.6)	10.6 (1.0)	57.3 (1.7)	17.6 (2.0)
10–19	25.9 (1.6)	5.9 (0.8)	11.2 (1.0)	55.5 (1.8)	13.2 (1.6)
20+	31.3 (1.8)	6.2 (1.0)	13.0 (1.2)	68.5 (1.8)	21.2 (2.6)

Notes: Adults are aged ≥18 y; cancer excludes superficial skin cancer. Data are from the National Health Interview Survey, 1998–2000. Numbers are given as percents (SE, standard error). ADL = activities of daily living; IADL = instrumental ADL. Dashes indicate sample sizes too small for reliable estimates; NA = not applicable.

*Results are shown for those under the age of 65 y.

[†]573 respondents reported more than one cancer (including superficial skin cancer). When more than one cancer had been diagnosed, site/type was categorized as the first diagnosed (excluding superficial skin cancer).

[‡]The number of years since diagnosis was calculated from the reported age at interview and age at first diagnosis. When more than one cancer was reported, years since the first diagnosis (excluding superficial skin cancer) were used to calculate years since diagnosis. In a few instances, a correction was made for respondents who provided years since diagnosis instead of age at diagnosis.

cancer survivors reporting an inability to work and another 7.4% limited in their ability to work, clinicians should consider the appropriateness of occupational therapy, rehabilitative services, and employment-related counseling. Although occurring less frequently, psychological problems for cancer survivors pose a high risk. Consistent with the literature (28–30), our analyses show that a major risk factor associated with psychological problems among cancer survivors is a diagnosis of cancer in adults under age 45. Surprisingly, there appears to be no diminution of risk with time from diagnosis.

This study's strength lies in the use of existing population-based NHIS data and maximizing its potential to provide the foundation for systematic in-depth studies.

The results can inform the conduct of prospective studies that are better able to identify the nature of the observed associations. The findings underscore the great need for prospective studies to identify how long-term effects of cancer, its treatment, and other factors contribute to disability. Questions regarding how to ameliorate the morbidity associated with cancer must be answered through carefully designed intervention studies.

The limitations of the study are due to the nature of the data collected. Results pertain only to the adult non-institutional household population and not to cancer survivors who reside in institutions (e.g., hospices or nursing homes). The NHIS interviews rely on self-reports of cancer, and such reports tend to underestimate cancer prevalence

Table 6. ORs and 95% CIs for the Model Identifying Characteristics Associated With Health and Disability Status Among Adults With a Self-Reported History of Cancer

Characteristic	Fair/Poor Self-Rep. Health Status [#]	Psychol. Problems [#]	≥1 ADL/IADL [#]	≥1 Functional Limit [#]	Unable to Work ^{**}
Site or Type of Cancer by Sex*					
Breast	—	—	—	—	—
Cervix	1.12 (0.82–1.53)	1.49 (0.89–2.52)	1.22 (0.78–1.90)	0.99 (0.76–1.30)	0.83 (0.49–1.41)
Prostate	0.81 (0.61–1.08)	0.95 (0.47–1.92)	0.51 (0.34–0.77)	0.59 (0.46–0.76)	0.71 (0.33–1.53)
Colon, rectum					
Male	0.86 (0.56–1.34)	0.55 (0.18–1.73)	0.55 (0.31–0.97)	0.78 (0.54–1.12)	1.12 (0.44–2.86)
Female	0.90 (0.63–1.30)	1.60 (0.82–3.15)	0.79 (0.53–1.19)	1.07 (0.74–1.54)	0.58 (0.26–1.29)
Uterus	0.98 (0.71–1.36)	0.91 (0.49–1.68)	1.35 (0.90–2.01)	1.27 (0.93–1.74)	1.32 (0.73–2.40)
Melanoma					
Male	0.68 (0.42–1.09)	0.88 (0.37–2.08)	0.36 (0.17–0.76)	0.72 (0.47–1.10)	0.45 (0.16–1.25)
Female	0.99 (0.61–1.61)	2.09 (0.82–5.35)	0.75 (0.40–1.39)	0.92 (0.63–1.36)	0.69 (0.27–1.80)
Larynx, lung, pharynx					
Male	1.69 (1.08–2.65)	2.41 (1.06–5.47)	0.97 (0.52–1.80)	0.73 (0.48–1.13)	1.37 (0.62–3.04)
Female	1.96 (1.16–3.29)	1.82 (0.63–5.31)	1.14 (0.56–2.32)	1.40 (0.78–2.52)	1.33 (0.50–3.56)
Leukemia, lymphoma					
Male	1.98 (1.11–3.53)	0.92 (0.32–2.67)	0.95 (0.49–1.85)	1.01 (0.58–1.76)	1.64 (0.68–3.96)
Female	1.59 (1.04–2.44)	1.43 (0.63–3.22)	1.42 (0.77–2.62)	1.51 (0.93–2.45)	1.68 (0.79–3.59)
Ovary	1.13 (0.70–1.83)	1.76 (0.87–3.56)	1.57 (0.89–2.75)	1.15 (0.73–1.80)	1.30 (0.65–2.62)
Other					
Male	1.28 (0.94–1.75)	1.05 (0.58–1.89)	0.83 (0.55–1.26)	0.80 (0.61–1.05)	1.72 (1.03–2.89)
Female	1.17 (0.86–1.61)	1.27 (0.73–2.21)	1.21 (0.79–1.86)	1.37 (0.99–1.88)	1.15 (0.67–1.98)
Age at interview, at diagnosis (y) [†]					
18–44, <44	0.44 (0.32–0.61)	2.36 (1.39–4.00)	0.17 (0.10–0.28)	0.27 (0.21–0.35)	0.59 (0.40–0.87)
45–64, <44	0.75 (0.56–1.01)	1.70 (0.94–3.09)	0.27 (0.17–0.42)	0.43 (0.33–0.58)	0.91 (0.59–1.42)
45–64, 45–64	0.99 (0.78–1.25)	1.23 (0.78–1.96)	0.34 (0.24–0.48)	0.53 (0.44–0.65)	—
65+, <44	1.14 (0.70–1.87)	0.40 (0.14–1.14)	0.26 (0.14–0.50)	0.53 (0.34–0.84)	NA
65+, 45–64	0.67 (0.52–0.85)	0.43 (0.22–0.84)	0.49 (0.35–0.68)	0.73 (0.58–0.92)	NA
65+, 65+	—	—	—	—	NA
Years since diagnosis					
<2	1.23 (0.87–1.75)	0.74 (0.38–1.45)	0.75 (0.48–1.16)	0.77 (0.56–1.08)	1.27 (0.71–2.28)
2–4	1.03 (0.74–1.43)	0.63 (0.33–1.18)	0.60 (0.39–0.91)	0.54 (0.40–0.74)	1.08 (0.63–1.85)
5–9	0.76 (0.55–1.05)	0.49 (0.28–0.88)	0.62 (0.43–0.92)	0.62 (0.46–0.85)	1.08 (0.64–1.81)
10–19	0.81 (0.60–1.08)	0.70 (0.41–1.21)	0.80 (0.56–1.13)	0.62 (0.47–0.81)	0.74 (0.46–1.20)
20+	—	—	—	—	—
Race/ethnicity					
White, non-Hispanic	—	—	—	—	—
White, Hispanic	1.84 (1.31–2.60)	0.92 (0.55–1.56)	0.97 (0.61–1.56)	0.70 (0.51–0.95)	1.07 (0.65–1.75)
Black	1.90 (1.45–2.50)	1.06 (0.61–1.82)	1.47 (1.05–2.05)	1.18 (0.91–1.54)	1.78 (1.19–2.64)
Other	1.64 (1.01–2.67)	1.16 (0.54–2.51)	1.79 (0.92–3.46)	0.69 (0.39–1.22)	1.55 (0.75–3.22)
Education [‡]					
< High school	1.82 (1.48–2.25)	1.14 (0.78–1.67)	1.70 (1.31–2.20)	1.48 (1.21–1.81)	2.18 (1.52–3.11)
High school or equivalent	—	—	—	—	—
> High school	0.64 (0.54–0.77)	0.69 (0.49–0.98)	0.99 (0.77–1.27)	0.81 (0.69–0.95)	0.86 (0.63–1.18)
Health insurance [§]					
Covered	—	—	—	—	—
Not covered	1.65 (1.20–2.27)	1.72 (1.06–2.80)	0.55 (0.28–1.08)	1.29 (0.97–1.72)	0.58 (0.36–0.92)
Marital status					
Never married	1.07 (0.74–1.53)	1.62 (0.93–2.81)	1.83 (1.17–2.88)	1.60 (1.18–2.16)	1.20 (0.77–1.85)
Married	—	—	—	—	—
Divorced, widowed, separated	1.07 (0.91–1.26)	1.24 (0.89–1.73)	1.88 (1.51–2.36)	1.24 (1.06–1.45)	2.33 (1.77–3.06)
No. of other chronic med. conditions [¶]					
0	—	—	—	—	—
1	2.57 (2.15–3.06)	2.12 (1.54–2.90)	2.10 (1.64–2.68)	2.27 (1.93–2.67)	2.51 (1.84–3.43)
2	6.50 (5.04–8.37)	3.56 (2.38–5.35)	4.37 (3.25–5.87)	5.26 (3.84–7.21)	7.43 (4.98–11.10)
3 or more	13.65 (9.07–20.55)	11.00 (6.69–18.07)	7.70 (4.96–11.95)	29.42 (12.48–69.34)	12.78 (6.28–26.01)

Notes: The Model is the multivariate logistic model; adults are aged ≥18 y. Cancer excludes superficial skin cancer; data are from the National Health Interview Survey, 1998–2000. OR = odds ratio; CI = confidence interval; NA = not applicable; dashes signify reference categories.

*573 respondents reported more than one cancer (including superficial skin cancer). When more than one cancer had been diagnosed, site/type was categorized as the first diagnosed (excluding superficial skin cancer).

[†]The number of years since diagnosis was calculated from the reported age at interview and age at first diagnosis. When more than one cancer was reported, years since the first diagnosis (excluding superficial skin cancer) were used to calculate years since diagnosis. In a few instances, a correction was made for respondents who provided years since diagnosis instead of age at diagnosis.

[‡]Limited to age 25 and older, an age when most would have completed their education.

[§]Those without health insurance coverage are persons who did not report having health care coverage at the time of the interview under private health insurance, Medicare, Medicaid, public assistance, a state-sponsored health plan, other government programs, or military health plan.

^{||}Those reporting that they were living with a partner were categorized as married.

[¶]Number reported includes reports of respondents ever being told by a physician or health professional that they had cardiovascular disease, diabetes (currently treated), emphysema, asthma (symptomatic in last 12 mo) or told in the last 12 mo that they had an ulcer, weak/failing kidneys, or a liver condition (see Appendix for details).

[#]See Appendix for a description of these dependent variables.

**Results are shown for those under the age of 65 y.

Table 7. Prevalence of Chronic Conditions and Smoking by Self-Reported History of Cancer for Adults

Characteristic	Self-Reported Cancer History (% , SE)				No Reported Cancer History (% , SE)			
	All	Age (y)			All	Age (y)		
		18–44	45–64	65+		18–44	45–64	65+
Smoking status								
Current	19.7 (0.6)	40.5 (2.0)	23.7 (1.3)	8.9 (0.6)	23.8 (0.2)	27.1 (0.3)	24.1 (0.3)	10.6 (0.3)
Former	37.9 (0.8)	16.9 (1.6)	38.3 (1.5)	45.8 (1.1)	21.9 (0.2)	13.3 (0.2)	29.9 (0.4)	38.9 (0.5)
Never	42.4 (0.8)	42.6 (1.9)	38.0 (1.4)	45.3 (1.1)	54.2 (0.2)	59.6 (0.3)	46.0 (0.4)	50.4 (0.5)
Cardiovasc. dis.*	27.9 (0.7)	10.6 (1.2)	20.6 (1.2)	39.3 (1.1)	11.3 (0.1)	4.4 (0.1)	13.6 (0.2)	33.2 (0.4)
Emphysema	4.8 (0.3)	—	3.9 (0.6)	6.9 (0.6)	1.3 (0.0)	0.2 (0.0)	1.7 (0.1)	4.8 (0.2)
Asthma (last 12 mo)	5.2 (0.3)	8.3 (1.0)	6.0 (0.7)	3.4 (0.4)	3.3 (0.1)	3.5 (0.1)	3.4 (0.1)	2.5 (0.1)
Ulcer (last 12 mo)	4.8 (0.3)	7.8 (1.1)	5.1 (0.6)	3.4 (0.4)	2.3 (0.1)	1.8 (0.1)	2.7 (0.1)	3.0 (0.2)
Diabetes (curr. treated)	9.2 (0.4)	1.6 (0.4)	8.0 (0.8)	13.0 (0.8)	4.4 (0.1)	1.2 (0.1)	6.8 (0.2)	11.8 (0.3)
Kidney prob. (last 12 mo)†	4.0 (0.3)	3.4 (0.7)	4.3 (0.6)	4.1 (0.4)	1.3 (0.0)	0.8 (0.0)	1.7 (0.1)	2.8 (0.2)
Liver condition (last 12 mo)	3.2 (0.3)	3.6 (0.7)	3.4 (0.5)	2.9 (0.3)	0.9 (0.0)	0.6 (0.0)	1.6 (0.1)	0.8 (0.1)

Notes: Adults are aged ≥ 18 y; cancer excludes superficial skin cancer. Data are from the National Health Interview Survey, 1999–2000. For self-reported history, $n = 4878$; for no reported history, $n = 90,737$. Dashes indicate sample sizes too small for reliable estimates. SE = standard error.

*Includes reports of having been told by a doctor or other health professional of a diagnosis of coronary heart disease, angina, history of heart attack or myocardial infarction, heart condition, or stroke.

†Includes reports of having been told by a doctor or other health professional of a diagnosis of failing or weak kidneys.

(31,32). In addition, the cross-sectional nature of the NHIS precludes inferring causal associations between a history of cancer and poor health and disability. In addition, although the effects of cancer survivorship on health status and disability were analyzed by controlling for several socio-demographic characteristics and the presence of comorbid chronic illnesses, there are likely unmeasured characteristics of respondents related to both survivorship and disability that could confound the apparent associations. Assessing levels of disability that are associated with cancer among cancer survivors is challenging because of the existence of higher levels of comorbidity at older ages (3,33,34).

In spite of these limitations, the NHIS data provide an extraordinary source of population-based information about cancer survivorship in the United States. Other population-

based surveys have identified cancer as an important cause of disability. The 1999 Survey of Income and Program Participation, for example, identified cancer as the 13th leading cause of disability and estimated that for 792,000 U.S. adults, cancer was the main health condition associated with their disability (35).

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Table 8. Use of Health Care Services and Disability Benefits by Self-Reported History of Cancer for Adults

Service/Benefit*	Self-Reported Cancer History (% , SE)				No Reported Cancer History (% , SE)			
	All	Age (y)			All	Age (y)		
		18–44	45–64	65+		18–44	45–64	65+
Total								
General doctor	80.6 (0.7)	70.9 (1.8)	78.0 (1.3)	86.0 (0.8)	65.0 (0.2)	58.5 (0.3)	69.3 (0.3)	81.3 (0.4)
Physician specialist	59.7 (0.8)	46.7 (2.0)	61.8 (1.4)	63.3 (1.1)	23.1 (0.2)	16.7 (0.2)	28.0 (0.3)	37.8 (0.4)
PT, OT, other therapist	12.8 (0.5)	12.1 (1.3)	12.6 (1.0)	13.2 (0.8)	6.7 (0.1)	5.2 (0.1)	8.1 (0.2)	9.7 (0.3)
Mental health	7.2 (0.4)	14.0 (1.3)	8.9 (0.8)	3.5 (0.4)	5.7 (0.1)	6.5 (0.1)	6.2 (0.2)	2.1 (0.1)
SSI disability benefit	2.8 (0.3)	4.2 (0.8)	4.0 (0.5)	1.5 (0.3)	1.5 (0.1)	1.2 (0.1)	2.1 (0.1)	1.9 (0.1)
Functional limit								
PT, OT, other therapist	18.2 (0.8)	20.6 (2.5)	19.0 (1.6)	17.3 (1.0)	15.1 (0.3)	15.8 (0.5)	16.0 (0.4)	13.4 (0.4)
Psychol. disability								
Mental health	34.6 (3.3)	44.7 (6.5)	42.4 (5.6)	15.7 (4.3)	32.7 (1.2)	34.2 (1.6)	38.0 (1.8)	13.1 (2.1)
Unable to work								
SSI disability benefit	19.5 (2.2)	27.2 (5.1)	16.8 (2.2)	NA	20.3 (0.7)	25.9 (1.4)	17.0 (0.8)	NA

Notes: Health care services are for use over the past year; adults are aged ≥ 18 y; cancer excludes superficial skin cancer; data are from the National Interview Health Survey, 1998–2000. For self-reported history, $n = 4878$; for no reported history, $n = 90,737$. NA = not applicable; SE = standard error.

*Sample adults reported whether they had, within the past year, seen or talked to a “general doctor who treats a variety of illnesses (a doctor in general practice, family medicine, or internal medicine),” a medical doctor who “specializes in a particular medical disease or problem (other than obstetrician/gynecologist, psychiatrist or ophthalmologist),” “a mental health professional such as a psychiatrist, psychologist, psychiatric nurse, or clinical social worker,” or had used “physical therapy (PT), occupational therapy (OT), respiratory therapy, or audiology services.” Sample adults (or a household proxy) also indicated whether Supplemental Security Income (SSI) was received and, if so, whether it was received because of a disability.

REFERENCES

1. Reis LAG, Eisner MP, Kosary CL, et al., eds. *SEER Cancer Statistics Review, 1973–1999*. Bethesda, MD: National Cancer Institute; 2002.
2. Edwards BK, Howe HL, Ries LAG, et al. Annual report to the nation on the status of cancer, 1973–1999, featuring implications of age and ageing on U.S. cancer burden. *Cancer*. 2002;94:2766–2792.
3. Yancik R. Epidemiology of cancer in the elderly: current status and projections for the future. *RAYS*. 1997;22(suppl 1):3–9.
4. Ganz PA, Rowland JH, Desmond K, Meyerowitz BE, Wyatt GE. Life after breast cancer: understanding women's health-related quality of life and sexual functioning. *J Clin Oncol*. 1998;16:501–514.
5. Shimozuma K, Ganz PA, Petersen L, Hirji K. Quality of life in the first year after breast cancer surgery: rehabilitation needs and patterns of recovery. *Breast Cancer Res Treat*. 1999;56:45–57.
6. Ganz PA, Desmond KA, Leedham B, Rowland JH, Meyerowitz BE, Belin TR. Quality of life in long-term, disease-free survivors of breast cancer: a follow-up study. *J Natl Cancer Inst*. 2002;94:39–49.
7. Ganz PA. The quality of life after breast cancer—solving the problem of lymphedema. *N Engl J Med*. 2001;340:383–385.
8. Erickson VS, Pearson ML, Ganz PA, Adams J, Kahn KL. Arm edema in breast cancer patients. *J Nat Cancer Inst*. 2001;93:96–111.
9. Paci E, Cariddi A, Barchielli A, et al. Long-term sequelae of breast cancer surgery. *Tumori*. 1996;82:321–324.
10. Meyers CA. Neurocognitive dysfunction in cancer patients. *Oncology (Huntingt)*. 2000;14:75–79.
11. Ahles TA, Saykin AJ, Furstenberg CT, et al. Neuropsychologic impact of standard-dose systemic chemotherapy in long-term survivors of breast cancer and lymphoma. *J Clin Oncol*. 2002;20:485–493.
12. Schag CA, Ganz PA, Wing DS, Sim MS, Lee JJ. Quality of life in adult survivors of lung, colon and prostate cancer. *Qual Life Res*. 1994;3:127–141.
13. Litwin MS, Hays RD, Fink A, et al. Quality-of-life outcomes in men treated for localized prostate cancer. *JAMA*. 1995;273:129–134.
14. Potosky AL, Harlan LC, Stanford JL, et al. Prostate cancer practice patterns and quality of life: The Prostate Cancer Outcomes Study. *J Natl Cancer Inst*. 1999;91:1719–1724.
15. Kornblith AB. Psychosocial adaptation of cancer survivors. In: Holland JC, ed. *Psychooncology*. Chap. 20. Oxford: Oxford University Press; 1998.
16. Gotay CC, Muraoka MY. Quality of life in long-term survivors of adult-onset cancers. *J Natl Cancer Inst*. 1998;90:656–667.
17. 2000 National Health Interview Survey (NHIS) Public Use Data Release, NHIS Survey Description. Washington, DC: US Dept of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, Division of Health Interview Statistics; March 2002.
18. 1999 National Health Interview Survey (NHIS) Public Use Data Release, NHIS Survey Description. Washington, DC: US Dept of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, Division of Health Interview Statistics; February 2002.
19. 1998 National Health Interview Survey (NHIS) Public Use Data Release, NHIS Survey Description. Washington, DC: US Dept of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics, Division of Health Interview Statistics; October 2000.
20. Institute of Medicine (IOM). *Disability in America: Toward a National Agenda for Prevention*. Washington, DC: National Academy Press; 1991.
21. Stata Statistical Software: Release 6.0. College Station, TX: StataCorp; 1999.
22. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. *Milbank Q*. 1996;74:511–544.
23. Von Korff M, Gruman J, Schaefer JK, Curry SJ, Wagner EH. Collaborative management of chronic illness. *Ann Intern Med*. 1997;127:1097–1102.
24. Sliwa JA, Marciniak C. Physical rehabilitation of the cancer patient. *Cancer Treat Res*. 1999;100:75–89.
25. Frymark SL. Taking control: cancer rehabilitation allows patients to increase the quality of their lives and reclaim independence. *Rehab Manage*. 1998;11:80–86.
26. Penfold SL. The role of the occupational therapist in oncology. *Cancer Treat Rev*. 1996;22:75–81.
27. Mellette SJ, Blunk KL. Cancer rehabilitation. *Semin Oncol*. 1994;21:779–782.
28. Ganz PA, Hirji K, Sim M, et al. Predicting psychosocial risk in patients with breast cancer. *Med Care*. 1993;31:419–431.
29. Zabora J, Brintzenhofesoc K, Curbow B, Hooker C, Piantadosi S. The prevalence of psychological distress by cancer site. *PsychoOncol*. 2001;10:19–28.
30. Mor V, Allen S, Malin M. The psychosocial impact of cancer on older versus younger patients and their families. *Cancer*. 1994;74(suppl 7): 2118–2127.
31. Desai MM, Bruce ML, Desai RA, Druss BG. Validity of self-reported cancer history: a comparison of health interview data and cancer registry records. *Am J Epidemiol*. 2001;153:299–306.
32. Hewitt M, Breen N, DeVesa S. Cancer prevalence and survivorship issues: analyses of the 1992 National Health Interview Survey. *J Natl Cancer Inst*. 1999;91:1480–1486.
33. Yancik R, Ganz PA, Varricchio CG, Conley B. Perspectives on comorbidity and cancer in older patients: approaches to expand the knowledge base. *J Clin Oncol*. 2001;19:1147–1151.
34. Yancik R, Wesley MN, Ries LA, Havlik RJ, Edwards BK, Yates JW. Effect of age and comorbidity in postmenopausal breast cancer patients aged 55 years and older. *JAMA*. 2001;285:885–892.
35. McNeil JM, Binette J. Prevalence of disabilities and associated health conditions among adults—United States, 1999. *MMWR*. 2001;50:120–125.

APPENDIX: NHIS QUESTIONS RELATED TO HEALTH STATUS AND DISABILITY

Some of the health status and disability-related questions were asked directly of the sample of adult respondents to the NHIS (i.e., history of cancer, other chronic illnesses, psychological problems, and functional limitations). Other measures were ascertained in the general household portion of the interview, where a household proxy response was used if the sample adult was not available (i.e., general health status, ADL/IADL, or health-related work limitations).

General health status: “Would you say [your/person’s] health in general is excellent, very good, good, fair, or poor?”

Chronic medical conditions: Respondents reported physician-diagnosed cardiovascular disease (i.e., report of coronary heart disease, angina, history of heart attack or myocardial infarction, heart condition, or stroke), emphysema, diabetes (currently treated), and the following conditions occurring in the last 12 months: asthma; ulcer; weak or failing kidneys; or liver condition.

Psychological problems: reports of feelings (i.e., feeling, at least some of the time, sad, nervous, restless or fidgety, hopeless, worthless, or that everything was an effort) in the past 30 days that had interfered with their life or activities a lot.

Limitation in ADL: “Because of a physical, mental, or emotional problem, [do you/does person] need the help of other persons with personal care needs, such as eating, bathing, dressing, or getting around inside this home?”

IADL: “Because of a physical, mental, or emotional problem, [do you/does person] need the help of other persons in handling routine needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?”

Functional limitations: Having any degree of difficulty without using any special equipment with walking a quarter of a mile, about three city blocks; walking up 10 steps without

resting; standing or being on your feet for about 2 hours; sitting for about 2 hours; stooping, bending or kneeling; reaching up over head; using fingers to grasp or handle small objects; lifting or carrying something as heavy as 10 lb such as a full bag of groceries; pushing or pulling large objects, such as a living room chair; going out to do things such as shopping, movies, or sporting events; participating in social activities, such as visiting friends, attending clubs and meetings, going to parties, relaxing at home or for leisure (reading, watching TV, sewing, listening to music).

Work limitation: “Does a physical, mental, or emotional problem now keep [you/person] from working at a job or business?” or are [you/person] “limited in the kind or amount of work [you/they] can do because of a physical, mental, or emotional problem?”

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