

Employment Outcomes of Men Treated for Prostate Cancer

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Background: Some organizations recommend prostate cancer screening for men younger than age 65 years, many of whom will be employed when they are diagnosed and treated for prostate cancer. Yet little is known about how prostate cancer and its treatment affect men's employment status. Consequently, we explored employment outcomes 6 and 12 months after the diagnosis of prostate cancer. **Methods:** We collected data from a prospective, population-based, longitudinal cohort of 267 men aged 30–65 years who had been diagnosed with prostate cancer and compared their likelihood of employment to that of men in two population-based control groups of 283 and 256 men without prostate cancer. The study outcomes were, among all participants, employment status and, among patients with prostate cancer, reasons why they remained employed, reasons why their weekly hours worked changed, and work-related disabilities. We predicted employment using probit regression models. In addition, we tested differences between the samples with two-sample Wilcoxon rank sum tests and chi-square tests. All statistical tests were two-sided. **Results:** Patients with prostate cancer were 10 percentage points (95% confidence interval [CI] = 2.50 to 17.51 percentage points; $P = .009$) less likely to be working 6 months after their diagnosis than men without prostate cancer. However, at 12 months after diagnosis, the likelihood of employment for prostate cancer patients and control subjects was not statistically significantly different ($P = .771$). Some patients reported that cancer and its treatment interfered with their ability to perform physical and cognitive tasks at work 12 months after diagnosis. For example, 26% (95% CI = 18.51% to 33.87%) of men (33 patients) reported that cancer interfered with their ability to perform tasks that involved physical effort. **Conclusions:** Prostate cancer and its treatment appear to have an impact on employment. [J Natl Cancer Inst 2005;97:958–65]

Prostate cancer is the most common cancer in men, and there are nearly 2 million prostate cancer survivors in the United States today. Most patients diagnosed with prostate cancer are older than age 65 years (1), but the age profile of patients with prostate cancer is likely to change because some organizations recommend screening men younger than age 65 years for prostate cancer. The U.S. Preventive Services Task Force found evidence that prostate cancer screening can detect early-stage prostate cancer but found “mixed and inconclusive evidence that early detection improves health outcomes” in average-risk, asymptomatic men aged 50 years and older (2). For African American and asymptomatic men with a family history of prostate cancer, the National Guidelines Clearinghouse recommends screening to start at age 40 years (3). Because of recommendations for prostate cancer

screening, an increase can be expected in the number of younger patients diagnosed and treated for prostate cancer—many of whom will be employed when they are diagnosed and treated. Patients who are treated for prostate cancer can have substantial complications, including urinary and bowel incontinence, that may interfere with their activities of daily living including their ability to work (4).

Because treatment choices for prostate cancer provide nearly equivalent survival benefits but may have substantially different medical complications, treatment choice may be heavily influenced by patient preference and negotiation between patients and their physicians. Treatments for prostate cancer include radical prostatectomy, interstitial or external beam radiotherapy, and androgen deprivation therapy. “Watchful waiting” is an alternative to treatment but is generally not recommended for patients younger than 65 years (5). Common complications of surgery and radiotherapy include urinary (e.g., incontinence, urgency, pain, and/or burning sensations), bowel (e.g., diarrhea, pain, bleeding, and/or abdominal cramping), and sexual dysfunction (6). Symptoms associated with androgen deprivation therapy include hot flashes, fatigue, breast tenderness, body weight changes, sexual dysfunction, and bone loss (7,8). Patients with prostate cancer experiencing physical problems stemming from treatment report emotional responses including anxiety and depression (9). In one study, 40% of patients who received radical prostatectomy reported low or moderate subjective quality of life 12 months after diagnosis (9). Bowel symptoms followed by sexual dysfunction appear to be associated with the greatest decrements in quality of life (10).

The influence of prostate cancer and its treatment on the patient's ability to work is virtually unknown. It is critical that information be obtained on how treatment and its symptoms will affect patients' day-to-day lives, which will more often include work as an increased number of younger patients are diagnosed and as older patients remain in the workforce. In addition, if they can anticipate disabilities or extended absences from work, patients undergoing treatment can better plan for the needed

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changes in their jobs. Physicians have an important role in communicating the impact that treatment will have on patients' ability to work.

To investigate the influence of prostate cancer treatment on work, we examined changes in employment status 6 and 12 months after a new diagnosis of prostate cancer for initially employed patients aged 30–65 years relative to those changes in two control groups of employed men constructed from the Current Population Survey. For men with prostate cancer who were employed after diagnosis, we also explored the reasons for employment and for the choices of hours worked and asked about work-related disabilities experienced by men with prostate cancer who remained in their jobs. This research is relevant to patients with prostate cancer and the physicians who advise them in considering treatment options and plans for absences from work or job restructuring after receiving treatment for prostate cancer.

PATIENTS AND METHODS

Data

We used the Metropolitan Detroit Cancer Surveillance System, a participant in the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program, and selected all patients within 3–4 months of a new prostate cancer diagnosis, during the study period, which began March 2001 and ended May 2003. We identified a total of 1210 potentially eligible patients. The Metropolitan Detroit Cancer Surveillance System is a population-based registry within the Detroit Metropolitan area (11,12). Our goal was to enroll approximately 300 prostate cancer patients and to obtain data on 300 control subjects so that a difference in the probability of a transition to nonemployment of .20 would be statistically significant at the 5% level. Study eligibility criteria were age between 30 and 65 years, English-speaking, and either employed or living with an employed spouse at the time of diagnosis; the details of study recruitment and enrollment have been described elsewhere (12). The lower age bound of 30 years was chosen because prostate cancer occurs more frequently after age 30 years than before age 30 years, and the upper age bound was chosen to restrict the study to men before the traditional age of retirement.

As required by the institutional review board (IRB), we mailed notification letters to the physicians of all potential patients. Physicians of 62 patients with prostate cancer (5% of potentially eligible patients) refused to allow study interviewers to contact their patients. Within 1 week of the mailing date, study interviewers successfully contacted 618 patients. Of these 618 patients, we enrolled 294 eligible patients who were either employed or had an employed spouse at the time of diagnosis; 223 (36%) of the contacted patients were ineligible for the study, and 92 patients refused to participate in the study. Nine additional patients were determined to be eligible but were excluded because study enrollment was complete before their baseline interview. The response rate for patients who met the age and employment eligibility criteria was 74% (294 patients of the 395 eligible patients). From this sample, we selected all 267 patients employed 3 months before diagnosis. Three patients declined participation between the baseline interview and the 6-month interview, and 21 dropped out of the study between the 6- and 12-month interviews. Reasons for dropout included refused to continue ($n = 18$),

too sick to continue in the study ($n = 2$), and death ($n = 1$). The percentage of enrolled patients retained at 12 months was 92%. IRB approvals (Michigan State University IRB 98-029 and Wayne State University IRB 09-20-98 [M02]-FB) were obtained for this study.

Because we studied patients who were initially employed, a control group was essential to avoid confounding the effects of cancer with labor market exits that occur periodically among men, regardless of illness. We therefore constructed a population-based control group from all respondents to the Current Population Survey residing in the Detroit Primary Metropolitan Statistical Area. The Current Population Survey is a monthly survey of 50 000 households conducted by the Bureau of the Census for the Bureau of Labor Statistics and is the primary source of information on labor force characteristics and behavior of the U.S. population. This survey has collected U.S. employment data for more than 50 years. Its sample is scientifically selected to represent the civilian noninstitutional population. Households participating in the Current Population Survey are in the survey for 4 consecutive months, are out of the survey for 8 consecutive months, and then are returned to the survey for another 4 consecutive months before leaving the sample permanently (13).

To the extent possible, patients in the cancer sample were asked employment questions identical to those found in the Current Population Survey in a similar order. In addition to questions about their work situation 6 and 12 months after a new diagnosis of prostate cancer, patients were asked to recall their employment situation approximately 3 months before diagnosis. The literature suggests that subjects can reliably recall these data up to 1 year after their occurrence (14). Specific questions regarding diseases such as prostate cancer are not part of the Current Population Survey, and so a few respondents in the control population may have prostate cancer (or other serious diseases). The presence of patients with prostate cancer in the control population would tend to diminish differences observed between the prostate cancer and control groups, but we suspect that this problem is small because the incidence rate of prostate cancer in younger men is very low. For example, the mean age of men in the control population is 48 years and the incidence rate of prostate cancer among men under age 50 years is only 7.99 per 100 000 men in the Detroit Metropolitan Area (1).

The earliest diagnosis month and year was June 2001, and the latest diagnosis month and year was May 2002. Thus, the period covered by the retrospective part of this study was between March 2001 and February 2002. The 6-month interview covered the period between December 2001 and November 2002 and the 12-month interview covered the period between June 2002 and May 2003. We selected respondents from the Current Population Survey in their fourth month (denoted as month-in-sample [MIS] 4) and fifth month (MIS 5), which are 9 months apart, as control subjects for the patient's information 3 months before diagnosis and 6 months after diagnosis, covering the same calendar months as the cancer sample. We used Current Population Survey respondents' data from MIS 1 and MIS 8, which are 15 months apart, to correspond with the patients' information 3 months before diagnosis and 12 months after diagnosis (11). Only one patient was younger than 40 years. Therefore, to obtain a control sample that would as closely as possible represent the age distribution in the cancer sample, we selected all male members of

households in the Current Population Survey between the ages of 40 and 65 years who were employed at MIS 1 or MIS 4. From MIS 1, 256 men met our selection criteria, and from MIS 4, 283 men met our selection criteria.

Variables

The study outcomes were 1) among all participants, employment 6 months after diagnosis or at MIS 5 and 12 months after diagnosis or at MIS 8, 2) among patients with prostate cancer, reasons for employment or changes in the number of weekly hours worked, and 3) among employed patients with prostate cancer, treatment-induced disabilities that interfered with patients' ability to work. A patient or control subject was considered employed if he was engaged in paid work at the time of the interview. Employed men reported the number of hours that they normally worked per week. If a change in hours worked occurred from one interview to the next, patients with prostate cancer were asked if treatment and/or its effects contributed to their decision to change the number of hours worked. In addition, employed patients with prostate cancer were asked if they continued to work to maintain health insurance or if they avoided changing jobs because they feared losing health insurance. If patients were employed, we also asked if they experienced difficulty performing tasks such as those involving physical effort, heavy lifting, stooping, concentrating, analyzing, keeping the pace set by others, or learning new things. Questions regarding job performance were extracted from the Health and Retirement Study (15), which has been widely used in longitudinal studies of the effects of health on employment and retirement decisions. If patients reported that they had difficulty performing tasks, we asked them if their difficulty was the result of having been diagnosed with and treated for prostate cancer.

We defined prostate cancer for our statistical models in two ways. First, prostate cancer was defined as a binary variable indicating whether or not the patient was diagnosed. Second, prostate cancer was defined categorically to represent local, regional and distant, and unknown stages. These stages are the SEER summary stages that indicate progression in metastases. Tumors that were unstaged but known to be invasive were categorized as invasive/unknown.

In addition to specifying stage of prostate cancer, we used the data from SEER registry supplemented by patient reports to identify the type of prostate cancer treatment received and included this information in some of our analyses. Treatment was categorized as follows: 1) hormone therapy, 2) radiation or chemotherapy, 3) surgery, and 4) watchful waiting. Some patients received radiation and/or hormone therapy in addition to surgery.

We controlled for individual characteristics including age, marital status, education, number of children younger than 18 years living at home, household income, and employment in a white-collar or blue-collar occupation. Household income was categorized as: household income greater than or equal to \$75 000; household income between \$20 000 and \$75 000; and household income less than or equal to \$20 000. The maximum household income category recorded in the interview was \$75 000 or more, and a household income of less than \$20 000 approximates poverty or near-poverty, although this depends on the number of household members.

Statistical Analysis

We tested differences between the samples using two-sample Wilcoxon rank sum tests for continuous variables and chi-square tests for categorical variables. We then estimated all employment equations by use of probit models. We used the Markov Chain Monte Carlo method (16), we imputed household income for 88 subjects for whom household income was missing. Variables used to impute income were age, race, marital status, education, employment status, number of children younger than 18 years living at home, month of interview, spouse's education, cancer stage, and treatment. The imputation was conducted by use of the program PROC MI in the SAS package of computer programs, version 9.1. All estimates were robust to whether we imputed income, excluded observations with missing income data from the analysis, or added a binary variable indicating "missing" income to the analysis and set the actual income variable to zero. For brevity, we report only estimates from models that include income imputations. Subjective outcomes regarding reasons for working or job disabilities occurring after cancer treatment were analyzed descriptively.

Differences in the patient and control samples can lead to biased estimates of the effect of cancer on employment (17). Therefore, we used propensity score methods to balance the characteristics of the patient and control groups (18). For a given patient in our sample, the propensity score is the probability of having prostate cancer that is based on observed characteristics (e.g., age and race). The process for propensity score estimation involves several steps. First, the probability of having cancer (i.e., the propensity score) was estimated with a probit model that included the demographic variables previously described. Second, the sample was partitioned into five or six strata on the basis of the estimated propensity score by using the nearest-neighbor method. When this process was complete, each stratum included patients who were relatively homogenous with respect to their likelihood of being diagnosed with cancer. Third, within each stratum, we determined whether the propensity score between the cancer patients and control subjects differed (i.e., the balancing-property test) and found that, within the strata, the groups were similar. Finally, each subject's propensity score was included in subsequent probit equations to estimate the likelihood of employment; the results were robust when linear probability models were used. We report our results with and without propensity scores in the estimations. All statistical tests were two-sided.

RESULTS

Descriptive Statistics

Descriptive statistics for the samples are presented in Table 1. Almost three quarters of the patients with prostate cancer were diagnosed with local-stage disease, which is associated with 5-year survival rates of nearly 100% (19). Of the 267 patients, 76.8% (205 patients) were treated with a surgical intervention and 40% (106 patients) received hormone therapy, radiation therapy, or chemotherapy. Of the 106 patients who received hormone therapy, radiation therapy, or chemotherapy, 54 of them received these therapies in addition to surgery. Only 3.8% (10 patients) selected watchful waiting.

Table 1. Descriptive statistics for initially employed men in the cancer and control samples*

| Characteristic | Prostate cancer patients (No. = 267) | Control subjects (MIS 4) (No. = 283) | Control subjects (MIS 1) (No. = 256) |
|---|---|---|---|
| Prostate cancer, No. (%) | | | |
| Local | 199 (74.5) | N/A | N/A |
| Regional/distant | 56 (21.0) | N/A | N/A |
| Invasive/unknown | 12 (4.5) | N/A | N/A |
| Treatment, No. (%) | | | |
| No treatment (watchful waiting) | 10 (3.8) | N/A | N/A |
| Hormone therapy | 42 (15.7) | N/A | N/A |
| Radiation or chemotherapy | 64 (24.0) | N/A | N/A |
| Surgery | 205 (76.8) | N/A | N/A |
| Mean age, y (SD) | 55.5 (5.9)† | 48.7 (6.7) | 48.3 (6.4) |
| Race/ethnicity, No. (%) | | | |
| African American, non-Hispanic | 65 (24.4)† | 35 (12.4) | 31 (12.0) |
| Marital status, No. (%) | | | |
| Married | 213 (79.8) | 218 (77.0) | 197 (77.0) |
| Divorced, separated, or widowed | 36 (13.5) | 38 (13.4) | 37 (14.5) |
| Never married | 18 (6.7) | 27 (9.5) | 22 (8.6) |
| Children ≤18 y living at home, No. (%) | 55 (20.6)† | 129 (45.6) | 116 (45.3) |
| Education, No. (%) | | | |
| No high school diploma | 17 (6.4)† | 15 (5.3) | 16 (6.3) |
| High school diploma | 45 (17.0)† | 92 (32.5) | 79 (30.9) |
| Some college | 88 (33.0)† | 80 (28.3) | 82 (32.0) |
| College degree | 117 (43.8)† | 96 (33.9) | 79 (30.9) |
| White collar, No. (%) | 170 (63.7) | 163 (57.6) | 149 (58.2) |
| Household income, No. (%) | | | |
| ≤\$20 000 | 7 (2.7)† | 7 (2.9) | 6 (2.8) |
| ≥\$75 000 | 161 (62.4)† | 112 (46.1) | 101 (46.5) |
| Employed at 6 mo, No. (%) | 191 (72.4)† | 252 (89.1) | N/A |
| Employed at 12 mo, No. (%) | 198 (80.5) | N/A | 221 (86.3) |
| Mean h worked per wk baseline, No. (SD) | 46.16 (12.6)‡ | 44.07 (9.8) | 46.17 (9.8) |
| Mean h worked per wk at 6 mo, No. (SD) | 42.47 (12.1) | 43.97 (8.8) | N/A |
| Mean h worked per wk at 12 mo, No. (SD) | 44.45 (12.9) | N/A | 44.00 (8.8) |

*N/A = not applicable; MIS = month in sample; SD = standard deviation.

†Statistically significant from control subjects ($P < .001$) using two-sided Wilcoxon tests for continuous variables and chi-square tests for categorical variables.

‡Statistically significant only from control subjects in MIS 4 ($P = .023$) using two-sided Wilcoxon tests.

The group of patients with prostate cancer differed from those of the two control samples along several demographic dimensions. Patients with prostate cancer were on average 7 years older and more likely to be African American (24% African American) than in the control groups (12% African American in MIS 4 and 12% in MIS 1). Among patients with prostate cancer, most (77%) had some college education, and 44% of patients had completed their college degrees, whereas, among men in the control samples, approximately 62% had some college education and approximately 34% had completed their college degrees. Men in the cancer sample were also more likely to have annual household incomes of more than \$75 000. The differences noted in the cancer and control groups underscore the need to balance the likelihood of having cancer based on observed individual characteristics.

Employment and the number of hours worked at each interview are also shown in Table 1. Of the patients employed 3 months before a prostate cancer diagnosis, excluding those who dropped out of the study, 191 (72%) of the 264 patients and 198 (81%) of the 243 patients, respectively, were employed 6 and 12 months after diagnosis. Thus, the employment rate for men with prostate cancer improved over time but remained statistically significantly lower ($P = .003$) than the baseline rate. Patients with prostate cancer who were employed at each observation period worked full-time, on average, and their weekly hours worked decreased only slightly 6 months after diagnosis, from an average

of 46 hours per week to an average of 42 hours per week. Patients with prostate cancer were not statistically significantly different from the noncancer control subjects with respect to hours per week worked. At 6 months after diagnosis, employed prostate cancer patients worked an average of 42 hours per week, and the MIS 4 control subjects who were employed at MIS 5 worked an average of 44 hours per week. Similarly, both the employed prostate cancer patients and MIS 1 control subjects employed at MIS 8 worked an average of 44 hours per week at 12 months after diagnosis.

Likelihood of Employment

Estimates for the likelihood of employment 6 months after diagnosis or at MIS 5 for the MIS 4 control group are presented in Table 2. Patients with prostate cancer were 10 percentage points (95% CI = 2.70 to 17.69 percentage points) less likely to remain employed than control subjects in the Current Population Survey control group ($P = .008$). Patients with local-stage and advanced-stage prostate cancers (e.g., regional or distant) had statistically significantly lower probabilities of continuing to work (10 percentage points [$P = .022$] and 16 percentage points [$P = .038$]) than men in the control group. In the estimation that controlled for treatment instead of for cancer stage, patients treated with surgical interventions were 17 percentage points (95% CI = 8.47 to 24.65; $P < .001$) less likely to remain employed

Table 2. Probit model (likelihood expressed as percentage points with 95% CIs) of employment, 6 months after diagnosis (n = 547)*

| Independent variable | Prostate cancer | <i>P</i> † | Cancer stage | <i>P</i> † | Treatment | <i>P</i> † | Propensity score | <i>P</i> † |
|------------------------------|-----------------------------|------------|-----------------------------|------------|-----------------------------|------------|------------------------------|------------|
| Propensity score | N/A | N/A | N/A | N/A | N/A | N/A | -34.23 (-121.14 to 52.67) | .440 |
| Prostate cancer‡ | -10.19 (-17.69 to -2.70) | .008 | N/A | N/A | N/A | N/A | -10.01 (-17.51 to -2.50) | .009 |
| Local stage‡ | N/A | N/A | -10.05 (-18.67 to -1.43) | .022 | N/A | N/A | N/A | N/A |
| Regional or distant stage‡ | N/A | N/A | -16.15 (-31.40 to -0.89) | .038 | N/A | N/A | N/A | N/A |
| Invasive/unknown stage‡ | N/A | N/A | -14.16 (-42.36 to 14.04) | .325 | N/A | N/A | N/A | N/A |
| Watchful waiting‡ | N/A | N/A | N/A | N/A | 8.93 (-5.57 to 23.44) | .227 | N/A | N/A |
| Hormone‡ | N/A | N/A | N/A | N/A | 13.15 (7.47 to 18.83) | <.001 | N/A | N/A |
| Chemotherapy or radiation‡ | N/A | N/A | N/A | N/A | -10.79 (-25.08 to -3.51) | .139 | N/A | N/A |
| Surgery‡ | N/A | N/A | N/A | N/A | -16.56 (-24.65 to -8.47) | .001 | N/A | N/A |
| African American§ | 0.48 (-7.72 to 8.69) | .908 | 1.02 (-7.18 to 9.21) | .808 | -2.05 (-10.74 to 6.65) | .644 | 6.78 (-9.09 to 22.65) | .403 |
| Age | -0.93 (-1.50 to -0.35) | .002 | -0.92 (-1.50 to -0.35) | .002 | -0.97 (-1.53 to -0.40) | .001 | -0.01 (-2.40 to 2.38) | .994 |
| Never married | -8.84 (-23.99 to 6.31) | .253 | -8.99 (-24.21 to 6.23) | .247 | -11.37 (-27.60 to 4.87) | .170 | -9.66 (-25.23 to 5.92) | .224 |
| Separated, widowed, divorced | -1.55 (-11.49 to 8.39) | .759 | -1.98 (-12.10 to 8.15) | .702 | -2.58 (-12.65 to 7.50) | .616 | -3.19 (-14.42 to 8.03) | .577 |
| High school¶ | 7.37 (-3.99 to 18.73) | .204 | 7.38 (-4.01 to 18.78) | .204 | 6.81 (-4.41 to 18.20) | .234 | 3.59 (-12.44 to 19.61) | .661 |
| Some college¶ | 11.16 (0.09 to 22.23) | .048 | 11.37 (0.32 to 22.42) | .044 | 10.90 (0.03 to 21.77) | .049 | 12.50 (1.19 to 23.81) | .030 |
| College graduate¶ | 10.53 (-2.54 to 23.60) | .114 | 10.64 (-2.45 to 23.73) | .111 | 9.70 (-3.18 to 22.57) | .140 | 11.93 (-1.46 to 25.32) | .081 |
| No. of children ≤18 y | 1.82 (-3.11 to 6.75) | .470 | 1.70 (-3.23 to 6.62) | .500 | 1.13 (-3.70 to 5.97) | .645 | -0.48 (-8.07 to 7.11) | .901 |
| White-collar# | 9.42 (0.96 to 17.88) | .029 | 9.38 (0.91 to 17.84) | .030 | 9.63 (1.23 to 18.03) | .025 | 8.69 (-0.03 to 17.42) | .051 |
| Household income ≥\$75 000** | 0.64 (-7.42 to 8.69) | .877 | 0.64 (-7.48 to 8.76) | .877 | 1.94 (-6.04 to 9.92) | .634 | 4.13 (-7.75 to 16.02) | .496 |
| Household income ≤\$20 000** | -1.67 (-20.84 to 17.49) | .864 | -1.89 (-21.09 to 17.30) | .847 | 1.79 (-17.22 to 20.80) | .854 | 1.36 (-19.57 to 22.29) | .898 |

*N/A = not applicable. N = 264 prostate cancer patients and 283 control subjects. Partial derivatives of probability with respect to independent variables are reported with 95% confidence intervals in parentheses. Coefficients and 95% CIs for month and year of interview are not reported. The propensity score was estimated based on age, race/ethnicity, education, marital status, number of children younger than age 18 years, and household income.

†Statistical significance is determined by Wald tests based on the asymptotic normal assumption.

‡Reference group = noncancer.

§Reference group = white/other.

||Reference group = married.

¶Reference group = no high school diploma.

#Reference group = non-white collar occupation.

**Reference group = household income between \$20 000 and \$75 000.

6 months after diagnosis than men in the control group, whereas men treated with hormone therapy had a higher probability of employment than men the control group (13 percentage points, 95% CI = 7.47 to 18.83 percentage points; $P < .001$). When the propensity of being in either the cancer or control group was added to the model, it had little impact on the estimated coefficients relative to prostate cancer. For example, men with prostate cancer were 10 percentage points (95% CI = 2.50 to 17.51 percentage points) less likely to remain employed than the non-cancer control subjects ($P = .009$), as in other estimations reported in Table 2 that did not include the propensity score.

Relative to control subjects, a higher percentage of prostate cancer patients retired from their jobs ($P = .006$). Specifically, 15 (6%) of 264 patients had retired from their jobs, whereas only four subjects (1%) of the 283 control subjects had retired from their jobs.

Among the other independent variables, age, education, and occupation were associated with the likelihood of employment. At 6 months after diagnosis and MIS 5, older men were less likely to be employed than younger men, and those with at least some college education were more likely to be employed than those without a high school diploma. Men who were employed in white-collar jobs were more likely to be employed than men who were employed in blue-collar jobs. Unlike previous studies examining employment outcomes for women with breast cancer, race was not statistically significantly associated with the likelihood of employment (10).

At 12 months after diagnosis (Table 3), patients with prostate cancer appeared to be recovering and returning to work. Their likelihood of employment was no longer statistically significantly different from the control group, regardless of cancer stage or

Table 3. Probit model (likelihood expressed as percentage points with 95% CIs) of employment, 12 months after diagnosis (n = 498)*

| Independent variable | Prostate cancer | <i>P</i> † | Cancer stage | <i>P</i> † | Treatment | <i>P</i> † | Propensity score | <i>P</i> † |
|------------------------------|----------------------------|------------|----------------------------|------------|----------------------------|------------|------------------------------|------------|
| Propensity score | N/A | N/A | N/A | N/A | N/A | N/A | -34.75 (-120.75 to 51.26) | .428 |
| Prostate cancer‡ | 1.10 (-6.31 to 8.51) | .771 | N/A | N/A | N/A | N/A | 1.53 (-5.95 to 9.02) | .688 |
| Local stage‡ | N/A | N/A | 4.15 (-3.33 to 11.63) | .277 | N/A | N/A | N/A | N/A |
| Regional or distant stage‡ | N/A | N/A | -6.50 (-19.49 to 6.49) | .327 | N/A | N/A | N/A | N/A |
| Invasive/unknown stage‡ | N/A | N/A | -1.73 (-25.54 to 22.09) | .887 | N/A | N/A | N/A | N/A |
| Watchful waiting‡ | N/A | N/A | N/A | N/A | 5.55 (-13.82 to 24.92) | .574 | N/A | N/A |
| Hormone‡ | N/A | N/A | N/A | N/A | 4.43 (-5.87 to 14.73) | .399 | N/A | N/A |
| Chemotherapy or radiation‡ | N/A | N/A | N/A | N/A | 1.86 (-8.73 to 12.45) | .730 | N/A | N/A |
| Surgery‡ | N/A | N/A | N/A | N/A | 1.15 (-5.99 to 8.28) | .753 | N/A | N/A |
| African American§ | 4.44 (-3.06 to 11.94) | .246 | 5.21 (-2.09 to 12.51) | .162 | 3.86 (-3.86 to 11.57) | .327 | 9.55 (-3.08 to 22.19) | .138 |
| Age | -0.93 (-1.52 to -0.34) | .002 | -0.95 (-1.53 to -0.37) | .001 | -0.99 (-1.58 to -0.40) | .001 | 0.12 (-2.53 to 2.77) | .931 |
| Never married | -3.22 (-17.32 to 10.88) | .654 | -3.52 (-17.76 to 10.72) | .628 | -3.63 (-18.01 to 10.76) | .621 | -3.12 (-17.22 to 10.97) | .664 |
| Separated, widowed, divorced | -4.19 (-14.59 to 6.21) | .429 | -5.35 (-16.09 to 5.38) | .328 | -4.25 (-14.75 to 6.25) | .427 | -6.50 (-19.01 to 6.02) | .309 |
| High school¶ | 9.27 (-0.22 to 18.75) | .056 | 9.49 (0.11 to 18.88) | .047 | 9.20 (-0.33 to 18.72) | .059 | 6.78 (-5.34 to 18.91) | .273 |
| Some college¶ | 5.91 (-5.07 to 16.90) | .291 | 6.48 (-4.38 to 17.34) | .242 | 5.57 (-5.54 to 16.69) | .326 | 7.56 (-3.81 to 18.93) | .193 |
| College graduate¶ | 5.69 (-6.67 to 18.15) | .370 | 5.86 (-6.58 to 18.30) | .356 | 5.25 (-7.32 to 17.81) | .413 | 8.47 (-5.35 to 22.30) | .230 |
| No. of children ≤18 y | 1.05 (-3.46 to 5.57) | .648 | 0.82 (-3.68 to 5.31) | .722 | 1.02 (-3.49 to 5.54) | .657 | -0.74 (-7.04 to 5.57) | .819 |
| White-collar# | 4.10 (-3.86 to 12.06) | .313 | 3.62 (-4.31 to 11.54) | .371 | 4.15 (-3.85 to 12.16) | .309 | 3.80 (-4.16 to 11.76) | .350 |
| Household income ≥\$75 000** | 5.25 (-2.18 to 12.69) | .166 | 5.10 (-2.34 to 12.54) | .179 | 5.53 (-1.95 to 13.01) | .147 | 7.28 (-1.65 to 16.21) | .110 |
| Household income ≤\$20 000** | -0.23 (-18.20 to 17.74) | .980 | -1.49 (-19.48 to 16.50) | .871 | 0.57 (-17.45 to 18.59) | .950 | 0.16 (-18.12 to 18.44) | .984 |

*N/A = not applicable. N = 243 control subjects and 255 prostate cancer patients. Partial derivatives of probability with respect to independent variables are reported with 95% CIs in parentheses. Coefficients and 95% CIs for month and year of interview are not reported. The propensity score was estimated based on age, race/ethnicity, education, marital status, number of children younger than age 18 years, and household income.

†Statistical significance is determined by the two-sided Wald tests based on the asymptotic normal assumption.

‡Reference group = noncancer.

§Reference group = white/other.

||Reference group = married.

¶Reference group = no high school diploma.

#Reference group = non-white collar occupation.

**Reference group = household income between \$20 000 and \$75 000.

treatment intervention. As in the 6-month analysis, a higher percentage of men (11%, 27 of 243 patients) with prostate cancer had retired from their jobs than men in the control sample (1%, three of 255 control subjects) ($P < .001$). Among 267 patients with prostate cancer, nearly 77% (205 patients) reported that they had paid sick leave. However, the presence of paid sick leave was not associated with employment 6 and 12 months after diagnosis among patients with prostate cancer. Information regarding availability of paid sick leave was not available for the Current Population Survey control sample.

Reasons for Employment Choices

Among the 69 men with prostate cancer who were working 6 months after a diagnosis, but worked fewer hours than they

had worked before diagnosis, 43% (30 patients) reported that they were unable to work at their former capacity because of symptoms related to treatment. At 12 months after diagnosis, only 15% (six patients) of the 39 patients who worked fewer hours than they had worked before diagnosis listed treatment-related symptoms as their reason for working fewer hours. Interestingly, 10 patients reported that they worked more hours 12 months after diagnosis than they had worked before diagnosis because they had renewed energy toward their jobs, which they attributed to having survived prostate cancer. Nearly 38% (72 patients) of the 191 employed patients stated that they continued to work to maintain their health insurance. Nine percent (22 patients) of these patients also indicated that they avoided changing jobs for fear of losing their health insurance. However, it is possible that the last two percentages would have been

Table 4. Work-related disabilities experienced by employed men with prostate cancer

| Job requirement | No.* | Cancer interfered, | | P† |
|--|------|--------------------|------------------|-------|
| | | No. (%) | 95% CI | |
| Physical effort | 126 | 33 (26) | (18.51 to 33.87) | <.001 |
| Heavy lifting | 74 | 22 (30) | (19.32 to 40.14) | <.001 |
| Stooping | 119 | 26 (22) | (14.42 to 29.27) | <.001 |
| Concentration | 219 | 26 (12) | (7.52 to 16.01) | .382 |
| Analysis | 197 | 17 (9) | (4.68 to 12.49) | .507 |
| Keeping up with the pace set by others | 148 | 23 (16) | (9.70 to 21.38) | .025 |
| Learning new things | 212 | 11 (5) | (2.19 to 8.13) | .019 |

*Number of patients reporting that their job involves the listed task. For example, 126 patients report that their job involved physical effort.

†The null hypothesis that the proportion equaled 0.1 was tested using two-sided normal tests for one sample proportion.

similar for the control sample had they been asked similar questions.

Treatment-induced Disabilities

A concern of health-care providers is whether patients experience persistent symptoms and disabilities as a result of their treatment. Table 4 shows data on employed patients with prostate cancer 12 months after their diagnosis, whose jobs involved certain tasks. The number and percentage of patients who reported difficulty in doing a particular task as a result of cancer are shown. Approximately 22%–30% of patients who performed physical tasks found that cancer and its treatment interfered with their ability to perform these tasks (e.g., those involving physical effort, heavy lifting, or stooping). For example, 26% (95% CI = 18.51% to 33.87%) of men (33 patients) reported that cancer interfered with their ability to perform tasks that involved physical effort. Only 5%–16% of patients noted an effect on tasks such as concentration, analysis, keeping up with others, and learning new things.

DISCUSSION

To our knowledge, this is the first study to examine employment outcomes among patients diagnosed with prostate cancer relative to a control group. The results indicate that previously employed patients diagnosed with prostate cancer were 10 percentage points less likely to be working 6 months after diagnosis than men in a noncancer control group. Among treatment options, surgical interventions appeared most likely to be associated with reduced employment. However, many patients returned to work 12 months after diagnosis. Nevertheless, a 6- to 12-month absence from work may cause a serious financial burden on patients treated for prostate cancer. In addition, among patients who remained employed at 12 months after diagnosis, up to 30% of the patients indicated that they were not able to perform specific job tasks because they had been treated for cancer.

Although it is largely absent from research investigating the outcomes of cancer treatment, the impact of prostate cancer treatment on patients' ability to work can be incorporated into patient and physician decisions regarding treatment. Improved information regarding the likelihood that a patient will be able to work after diagnosis and treatment may result in improved

decisions and more realistic planning for time away from work or job restructuring during or after treatment. Some patients may not be able to work for 6 months or more after treatment. In addition, although many men remained employed throughout the study, they cited symptoms related to prostate cancer treatment as the reason that they could not work at their former capacity. Because the superiority of one prostate cancer treatment over another has not been clearly demonstrated, patients may select treatments or (or choose watchful waiting) that allow them to remain engaged at work. Finally, because health insurance is linked to employment, a connection to the workforce may be essential for continuing access to health care. Nevertheless, the longer-term view (i.e., 1 year after diagnosis) of employment outcomes for patients treated with prostate cancer appears promising.

Our study has four limitations. First, the sample was drawn from the Detroit Metropolitan Area, and thus the results may not reflect the experiences of men in other geographic or rural areas. Second, few patients with prostate cancer had low household incomes. Perhaps asymptomatic working-aged men with low incomes do not seek routine preventive health care that includes prostate cancer screening. We suspect, but cannot be certain, that men with lower incomes would experience greater work loss than men in our sample because they may be employed in physically intensive jobs that would be more challenging while they are undergoing cancer treatment. Third, the study lacks data on treatment dose and intensity, supportive care, use of rehabilitation services, and provider characteristics. The value of more detailed clinical data and how it predicts the return to work experiences of patients with prostate cancer should be the subject of future research. Finally, the demographic characteristics of the control group differed from the prostate cancer patients' demographic characteristics and information regarding paid sick leave was not available for the control subjects.

The national emphasis on cancer screening and early detection will result in more individuals being diagnosed and treated for prostate cancer during their working years. Although early detection and treatment may have positive implications for mortality, it may inflict morbidity—at least in the months immediately after treatment—that will interfere with patients' ability to work. Armed with this information, patients can more effectively plan for extended periods of nonemployment with the optimism that they are likely to be able to return to work 1 year after diagnosis. However, patients employed in physically demanding jobs may experience difficulty performing their usual job tasks.

We suggest that the impact of cancer and its treatment on employment be considered alongside clinical and quality-of-life assessments when patients and physicians make prostate cancer treatment decisions. Data regarding possible periods of nonemployment and reasonable expectations for recovery can be integrated into patient and physician discussions so that a therapeutic regimen that is optimal for both treating the disease and meeting the work-related needs of the patient is selected.

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