
Cigarette Smoking and Health-Related Quality of Life in Medicare Beneficiaries

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This study examined associations between cigarette smoking, cancer, and self-reported physical (SF-36[®] Physical Component Summary Score, [PCS]) and mental health (SF-36[®] Mental Component Summary Score, [MCS]) among 123,567 Medicare beneficiaries enrolled in managed care plans. As expected for a sample of older individuals, the SF-36[®] PCS mean (42.6) was lower than the U.S. general population mean of 50. The SF-36[®] MCS mean (51.7) for the sample was higher than the general population mean. In addition, least squares means revealed significantly poorer health for current smokers and those who recently quit, regardless of their cancer status. Although statistically significant, the differences between current smokers and never smokers were small among those with or without cancer. Encouraging smokers to quit and providing abstinence support to persons who have recently quit may help reduce health-related impacts of cigarette use.

INTRODUCTION

Cigarette smoking increases the risk for several types of cancer, including cancers

of the lip, oral cavity, pharynx, esophagus, pancreas, larynx, lung, uterine cervix, urinary bladder, and kidney (Centers for Disease Control and Prevention, 2008). The risk of dying from lung cancer is more than 22 times higher among males who smoke cigarettes and approximately 12 times higher among females who smoke cigarettes compared with never smokers. Smoking in older adults may be particularly important given the increased prevalence of smoking-related diseases with age. It is estimated that between 1995 and 2015, tobacco-related diseases will cost Medicare about \$800 billion (Arday et al., 2002).

Research has found that a history of cigarette use is associated with poorer self-reported physical and mental health (Arday et al., 2003; Garces et al., 2004; U.S. Department of Health and Human Services, 2004). Some studies have found that recent quitters have the worst self-reported physical and mental health while longer term quitters have similar health (especially mental health) as those who never smoked (Arday et al., 2003). In previous research, the magnitude of the differences observed in perceived health between subgroups with varying histories of smoking has ranged from small to medium (0.20-0.50) effect sizes.

Having a cancer diagnosis versus not has been shown to be associated with worse perceived physical (Boini et al., 2004) and mental health (Baker, Haffer, and Denniston, 2003), with multiple cancer diagnoses related to even worse perceived health (Clauser et al., 2008). Whether the relationship

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between smoking and self-reported health is the same for those with and without a diagnosis of cancer is unclear. It is possible that smoking has a larger impact on self-rated physical health among those with cancer than those without because of multiplicative detrimental effects of disease and tobacco on the body. In addition, the extent to which the association between smoking and self-reported health varies by type of cancer needs to be further explored.

The objectives of this study were to compare self-reported health among Medicare beneficiaries by smoking status and to evaluate whether the associations vary by whether or not one has been diagnosed with cancer. Among those with cancer, we examined whether the association of smoking history with health varies by cancer type. We use linked data from the CMS Medicare Health Outcomes Survey (MHOS) and NCI's Surveillance, Epidemiology and End Results (SEER) program. Because of the large sample size and detailed information about multiple cancers, this data linkage project allows greater exploration of these issues in older adults than previously possible (Ambs et al., 2008; Clauser et al., 2008).

METHODS

Sample

The sample consisted of Medicare beneficiaries age 65 or over enrolled in managed care plans. As previously noted, data were from a linkage of the MHOS (Jones, Jones, and Miller, 2004) and the SEER cancer registries (Ries et al., 2007). The SEER program includes population-based cancer registry sites throughout the U.S. Currently the SEER program includes 18 population-based cancer registries that represent approximately 26 percent of the U.S. population (Ries et al., 2007). Data from the

SEER-MHOS linkage includes 14 of the 18 SEER registries. The sample was limited to respondents who resided in these SEER regions.

The MHOS is a yearly survey that is administered to a random sample of 1,000 Medicare beneficiaries from each managed care plan under contract with CMS. The linked SEER-MHOS dataset includes four MHOS cohorts (baseline and followup year): 1998 and 2000; 1999 and 2001; 2000 and 2002; and 2001 and 2003. Across the four cohorts, we identified a total sample of 123,567 persons age 65 or over who had completed at least one survey and had complete data on the variables included in the analyses. For the 109,150 people without a cancer diagnosis, we included the first survey they completed. Participants with cancer ($n = 14,417$) were identified through SEER, and the first survey completed after their cancer diagnosis was used. We restricted this subgroup to those with a first diagnosis of other cancer ($n = 1,831$) or one of nine prevalent cancers: (1) prostate ($n = 4,055$), (2) breast ($n = 3,118$), (3) colorectal ($n = 1,924$), (4) non-small cell lung ($n = 596$), (5) bladder ($n = 773$), (6) endometrial ($n = 730$), (7) melanoma ($n = 724$), (8) non-Hodgkin's lymphoma ($n = 393$), and (9) kidney cancer ($n = 273$).

Data

The MHOS includes survey items assessing demographic characteristics, chronic medical conditions, and smoking status. We included these items in the analyses because of their hypothesized associations with self-reported physical and mental health. Demographic variables in the MHOS included age, race/ethnicity, education, sex, income, and current marital status. Age was scored continuously. Those who reported Hispanic ethnicity were coded as such. The others were catego-

rized into five mutually exclusion race/ethnic categories: (1) White, (2) Black, (3) Asian, (4) American Indian, and (5) Other. Education had six categories ((1) eighth grade or less; (2) some high school; (3) high school graduate; (4) some college; (5) 4-year college graduate; and (6) more than 4-year college degree) and was treated as a continuous variable for the analysis. Sex was coded as a dummy variable (male = 1; female = 0). Seven income categories were used: (1) <\$10,000; (2) \$10,000-\$19,999; (3) \$20,000-\$29,999; (4) \$30,000-\$39,999; (5) \$40,000-\$49,999; (6) \$50,000-\$79,999; (7) \$80,000 or more. Marital status was operationalized as married, widowed, or otherwise not married.

Respondents were asked whether they had been told by a doctor that they had any of 12 chronic medical conditions: (1) hypertension or high blood pressure, (2) coronary artery disease, (3) congestive heart failure, (4) myocardial infarction or heart attack, (5) other heart conditions, (6) stroke, (7) chronic obstructive pulmonary disease, (8) inflammatory bowel disease, (9) arthritis of the hip or knee, (10) arthritis of the hand or wrist, (11) sciatica, and (12) diabetes.

We used three MHOS smoking questions: (1) Have you ever smoked at least 100 cigarettes in your entire life? (2) Do you now smoke every day, some days, or not at all? (3) How long has it been since you quit smoking? For the first MHOS cohort, the response options for the third question were: less than 12 months, 12 months or more, and don't know. The duration of the response options were changed for the subsequent three cohorts from 12 months to 6 months. We constructed five levels of smoking status from these questions: (1) never smoked ($n = 56,170$, 45 percent of the sample); (2) longer-term quitter ($n = 46,095$, 37 percent); (3) unsure when quit ($n = 6,926$, 6 percent), (4) recent quitter (n

= 1,090, 1 percent), and (5) current smokers ($n = 13,286$, 11 percent). Longer term quitters were those who quit smoking 12 months or longer for the first cohort and 6 months or longer for the other cohorts. To adjust for this difference in timeframe, we included a dummy variable to indicate whether or not the respondent was in the first cohort.

The MHOS included the SF-36[®] health survey, version 1 (Ware and Sherbourne, 1992) and we used the SF-36[®] PCS and MCS as the dependent variables in this study. The PCS and MCS are scored on a *T*-score metric so that a higher score reflects better health and the average in the U.S. general population is 50 (standard deviation [SD] is 10). The majority of the sample completed the MHOS survey by mail (88 percent) and 12 percent required a proxy to help complete the survey. A dummy variable was created to adjust for the fact that proxies reports of health can differ systematically from self-reports (Hays et al., 1995).

Analyses

All analyses were performed using SAS[®] (version 9.1.3) software. We present descriptive statistics for the sample overall and by smoker subgroups. Then, we estimate least square regression models to obtain adjusted means on the SF-36[®] PCS and MCS (one model for each dependent variable) by smoker and cancer subgroups, adjusting for the 12 chronic medical conditions, education, sex, marital status, age, race/ethnicity, income, whether a proxy completed the survey, cohort (cohort 1 versus others), and mode of administration (mail versus telephone). Regression parameter standard errors were adjusted for clustering at the health plan level (White, 1980) using the SAS[®] SURVREG procedure.

We use Cohen's (1992) effect size rule of thumb to define the minimally important difference (MID) for the SF-36[®] (Hays, Farivar, and Lin, 2005). A mean difference of less than 0.20 SD is not likely to be meaningful, whereas a difference of between 0.20 SD (i.e., a small effect) and 0.50 SD (i.e., a medium effect) is a potential indicator of the MID. Consistent with this approach, Walters and Brazier (2003) reported MID estimates ranging from 0.11 to 0.48 SD, with a mean of 0.30 SD for the SF-6D. Kosinski et al. (2000) reported an average MID estimate of 0.27 for the SF-36[®] MCS and 0.39 for the SF-36[®] PCS in a study of rheumatoid arthritis that employed five anchors: (1) self-report, (2) clinician report, (3) global report of pain, (4) joint swelling, and (5) joint tenderness. Hence, 2-point differences or greater on the SF-36[®] PCS and MCS were considered big enough to be important.

RESULTS

Table 1 shows that the overall sample of 123,567 respondents had an average age of 74.1 years (range: 65-107). The sample was 44 percent male, 8 percent Hispanic, 80 percent White, 5 percent Black, 5 percent Asian, 1 percent American Indian, and 2 percent Other race. One-quarter of the sample had less than a high school education. Income was less than \$40,000 for 63 percent of the sample. The majority were married (60 percent). The average number of comorbid conditions reported was 2.3, with a range of 0-12 comorbid conditions. Twelve percent of the sample had chronic obstructive pulmonary disease (COPD). The SF-36[®] PCS was lower than the general population mean of 50 (PCS = 42.6), as expected for a sample of older individuals. The SF-MCS mean was higher than the general population (MCS = 51.7).

Table 1 also gives demographic and selected characteristics separately for those with and without a cancer diagnosis. It is important to keep in mind that small differences between subgroups can be statistically significant when there are large sample sizes. Those with cancer were significantly older, more likely to be males, less likely to be Hispanic, more likely to be White, tended to be more educated, have a higher income, more likely to be married, had a greater number of comorbid conditions, to have COPD, and reported worse physical and mental health than those without cancer.

Table 2 shows demographic and selected characteristics by smoker status. The omnibus test for each variable was statistically significant. The biggest differences between subgroups were that those who never smoked were less likely than those who ever smoked to be males and less likely to have COPD. Among the smoker status groups, the percentage of the Hispanics was highest for those who were unsure when they quit smoking and smallest for the longer term quitters. Current smokers were the least likely and longer term quitters were the most likely to be married. The largest percentage of proxy responses were obtained among those who never smoked.

Table 3 provides least squares adjusted means on the SF-36[®] PCS and MCS by smoker status and whether or not the person had one of the nine cancers identified in SEER. Those without cancer reported better physical and mental health than those with cancer and the differences were statistically significant except for MCS for those who never smoked. Interactions between sex and smoking status on self-reported health were evaluated and found to be not significant. In addition, we evaluated sensitivity of the mean differences by smoker status due to the difference in the wording

Table 1

Demographic and Selected Characteristics for Participants With and Without Cancer in Medicare Health Outcomes Survey and NCI's Surveillance, Epidemiology, and End Results Dataset: 1998-2003

Variable	Overall ¹	Cancer ²	No Cancer ³	Test of Cancer Versus No Cancer
Mean Age (SD)	74.1 (6.4)	75.3 (6.4)	74.0 (6.4)	$t(123,565) = 23.32^{***}$
		Percent		
Male	44	52	43	$\chi^2(1) = 456.7^{***}$
Race/Ethnicity				
Hispanic	8	5	8	$\chi^2(1) = 103.1^{***}$
White	80	82	80	$\chi^2(1) = 58.1^{***}$
Black	5	5	5	$\chi^2(1) = 0.6$ n.s.
Asian	5	5	5	$\chi^2(1) = 0.6$ n.s.
American Indian	1	0.51	0.51	$\chi^2(1) = 0.01$ n.s.
Other	2	2	2	$\chi^2(1) = 0.03$ n.s.
Education				
8 th Grade or Less	11	10	11	$\chi^2(1) = 27.2^{***}$
Some High School	14	14	14	$\chi^2(1) = 0.3$ n.s.
High School Graduate	33	32	33	$\chi^2(1) = 6.8^{**}$
Some College	24	25	24	$\chi^2(1) = 2.5$ n.s.
4 Year College Graduate	8	9	8	$\chi^2(1) = 7.3^{**}$
More Than 4-Year College Degree	9	10	9	$\chi^2(1) = 32.6^{***}$ $\chi^2(5) = 67.1^{***}$
Income				
< \$10,000	11	9	11	$\chi^2(1) = 58.7^{***}$
\$10,000-\$19,999	22	22	22	$\chi^2(1) = 0.09$ n.s.
\$20,000-\$29,999	18	18	17	$\chi^2(1) = 1.6$ n.s.
\$30,000-\$39,999	12	12	12	$\chi^2(1) = 3.9^*$
\$40,000-\$49,999	7	8	7	$\chi^2(1) = 7.6^{**}$
\$50,000-\$79,999	8	8	8	$\chi^2(1) = 5.6^*$
\$80,000 or More	4	5	4	$\chi^2(1) = 7.5^{**}$
Do Not Know/Missing	19	18	19	$\chi^2(1) = 3.5$ n.s. $\chi^2(7) = 79.2^{***}$
Married	60	61	59	$\chi^2(1) = 18.7^{***}$
Number of Comorbid Conditions (SD)	2.3 (1.9)	2.4 (1.9)	2.3 (1.8)	$t(18,328) = 7.94^{***}$
		Percent		
Chronic Obstructive Pulmonary Disease	12	13	12	$\chi^2(1) = 24.8^{***}$
SF-36 [®] PCS (SD)	42.6 (12.5)	40.4 (12.7)	42.8 (12.5)	$t(18,291) = - 21.94^{***}$
SF-36 [®] MCS (SD)	51.7 (11.9)	50.7 (12.5)	51.8 (11.9)	$t(18,023) = - 10.13^{***}$
Mail Mode	88	88	88	$\chi^2(1) = 0.8$ n.s.
Proxy	12	12	12	$\chi^2(1) = 0.5$ n.s.

* $p < 0.05$.** $p < 0.01$.*** $p < 0.001$.¹ $n = 123,567$.² $n = 14,417$.³ $n = 109,150$.

NOTES: SD is standard deviation. n.s. is not significant. PCS is Physical Component Summary Score. MCS is Mental Component Summary Score.

SOURCE: The dataset links the National Cancer Institute's (NCI's) Surveillance, Epidemiology, and End Results (SEER) cancer registry data with Medicare beneficiaries' responses to the Centers for Medicare & Medicaid Services' Medicare Health Outcomes Survey (MHOS). The linked SEER-MHOS dataset includes one survey for participants in four MHOS cohorts (baseline and followup year): 1998 and 2000; 1999 and 2001; 2000 and 2002; and 2001 and 2003. For non-cancer patients the survey is the first one they completed. For those with a cancer diagnosis, the survey is the first one completed following their cancer diagnosis.

Table 2

Demographic and Selected Characteristics for Participants, by Smoker Status in Medicare Health Outcomes Survey and NCI's Surveillance, Epidemiology, and End Results Dataset: 1998-2003

Variable	Never Smoker ¹	Longer Term Quitter ²	Unsure When Quit ³	Recent Quitter ⁴	Current Smoker ⁵	Test of Differences by Smoker Status
Age (Mean)	75	73.5	75.4	72.3	72	F(4,123,562) = 841.8***
	Percent					
Male	30	58	51	48	47	$\chi^2(4) = 8404.6^{***}$
Race/Ethnicity						
Hispanic	9	6	10	7	7	$\chi^2(4) = 439.4^{***}$
White	77	85	77	83	80	$\chi^2(4) = 1060.4^{***}$
Black	5	4	6	5	7	$\chi^2(4) = 272.2^{***}$
Asian	6	3	4	3	3	$\chi^2(4) = 614.2^{***}$
American Indian	0.46	0.48	1	1	1	$\chi^2(4) = 17.3^{**}$
Other	2	2	1	2	2	$\chi^2(4) = 22.0^{***}$
Education						
8th Grade or Less	13	8	15	13	12	$\chi^2(4) = 674.3^{***}$
Some High School	13	14	21	18	19	$\chi^2(4) = 569.3^{***}$
High School Graduate	34	31	34	33	34	$\chi^2(4) = 74.4^{***}$
Some College	22	27	21	24	23	$\chi^2(4) = 311.4^{***}$
4-Year College Graduate	8	10	5	7	6	$\chi^2(4) = 307.5^{***}$
More Than 4-Year College Degree	10	10	5	5	6	$\chi^2(4) = 488.1^{***}$
						$\chi^2(20) = 2097.6^{***}$
Income						
< \$10,000	12	8	13	16	15	$\chi^2(4) = 778.6^{***}$
\$10,000-\$19,999	22	20	25	24	27	$\chi^2(4) = 296.2^{***}$
\$20,000-\$29,999	16	19	18	19	18	$\chi^2(4) = 110.3^{***}$
\$30,000-\$39,999	11	13	11	11	10	$\chi^2(4) = 206.7^{***}$
\$40,000-\$49,999	7	9	5	6	6	$\chi^2(4) = 231.0^{***}$
\$50,000-\$79,999	7	10	5	6	6	$\chi^2(4) = 404.1^{***}$
\$80,000 or More	4	5	2	3	2	$\chi^2(4) = 289.9^{***}$
Do Not Know/Missing	21	16	21	16	16	$\chi^2(4) = 369.2^{***}$
						$\chi^2(28) = 2,362.1^{***}$
Married	57	66	62	56	51	$\chi^2(4) = 1,341.9^{***}$
Comorbid Conditions	2.2	2.5	2.5	2.6	2.2	F(4,123,562) = 176.3***
Chronic Obstructive Pulmonary Disease	7	15	13	30	19	$\chi^2(4) = 2,510.4^{***}$
SF-36® PCS	42.9	42.4	41.6	39.8	42.4	F(4,123,562) = 35.6***
SF-36® MCS	51.7	52.5	50.5	48.8	49.8	F(4,123,562) = 164.7***
Mail Mode	87	89	96	89	87	$\chi^2(4) = 564.4^{***}$
Proxy	14	10	11	11	11	$\chi^2(4) = 400.8^{***}$

*p<0.05.

**p<0.01.

***p<0.001.

¹n = 56,170.²n = 46,095.³n = 6,926.⁴n = 1,090.⁵n = 13,286.

NOTES: Recent quitters were those who stopped smoking within the past 12 (6) months for cohorts 1 (2-4). Longer term quitters are those who stopped smoking for at least 12 (6) months for cohorts 1 (2-4). PCS is Physical Component Summary Score. MCS is Mental Component Summary Score.

SOURCE: The dataset links the National Cancer Institute's (NCI's) Surveillance, Epidemiology, and End Results (SEER) cancer registry data with Medicare beneficiaries' responses to the Centers for Medicare & Medicaid Services' Medicare Health Outcomes Survey (MHOS). The linked SEER-MHOS dataset includes one survey for participants in four MHOS cohorts (baseline and followup year): 1998 and 2000; 1999 and 2001; 2000 and 2002; and 2001 and 2003. For non-cancer patients the survey is the first one they completed. For those with a cancer diagnosis, the survey is the first one completed following their cancer diagnosis.

Table 3
Associations of SF-36® Physical Component Summary Score (PCS) and Mental Health Component Summary Score (MCS) with Smoker Status

Summary Score	Never Smoker ¹	Longer Term Quitter ²	Unsure When Quit ³	Recent Quitter ⁴	Current Smoker ⁵
SF-36® PCS					
No Cancer	43.0 [a]	42.5 [b]	43.0 [a]	40.7 [d]	41.6 [c]
Cancer	41.0 [b, c, d]	40.7 [d]	41.4 [c, d]	38.2 [e]	40.3 [d]
SF-36® MCS					
No Cancer	51.8 [b]	52.5 [a]	51.4 [c]	49.8 [e, f]	49.9 [e]
Cancer	50.2 [b-f]	51.1 [c, d]	50.5 [d, e]	47.0 [g]	48.5 [f, g]

¹n = 56,170.

²n = 46,095.

³n = 6,926.

⁴n = 1,090.

⁵n = 13,286.

NOTES: Recent quitters were those who stopped smoking within the past 12 (6) months for cohorts 1 (2-4). Longer term quitters are those who stopped smoking for at least 12 (6) months for cohorts 1 (2-4). Adjusted for age, sex, marital status, education, race/ethnicity, income, chronic conditions, mode of administration, cohort (1 versus 2-4) and proxy response. Letters within brackets indicate whether the subgroup in that cell differs significantly from the other 9 subgroups for the dependent variable (PCS or MCS). Least squares means for subgroups that share a letter do not differ significantly on *t*-test ($p < 0.05$) from one another.

SOURCE: The dataset links the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) cancer registry data with Medicare beneficiaries' responses to the Centers for Medicare & Medicaid Services' Medicare Health Outcomes Survey (MHOS). The linked SEER-MHOS dataset includes one survey for participants in four MHOS cohorts (baseline and followup year): 1998 and 2000; 1999 and 2001; 2000 and 2002; and 2001 and 2003. For non-cancer patients the survey is the first one they completed. For those with a cancer diagnosis, the survey is the first one completed following their cancer diagnosis.

Table 4
Associations of SF-36® Physical Component Summary Score (PCS) and Mental Health Component Summary Score (MCS) with Smoker Status (Cohort 1 Only; n = 34,020)

Summary Score	Never Smoker ¹	Longer Term Quitter ²	Unsure When Quit ³	Recent Quitter ⁴	Current Smoker ⁵
SF-36® PCS					
No Cancer	43.4 [a]	43.1 [b]	43.3 [a, b]	41.3 [c, d, e]	42.2 [c]
Cancer	42.9 [a-e]	41.1 [d, e]	42.4 [a-e]	37.8 [e]	39.8 [e, f]
SF-36® MCS					
No Cancer	51.9 [b]	52.3 [a]	51.9 [a, b]	48.7 [c, d]	50.1 [c]
Cancer	48.0 [b-e]	51.2 [b]	49.5 [b, c, d]	44.5 [e]	47.0 [d, e]

¹n = 15,518.

²n = 13,183.

³n = 1,244.

⁴n = 426.

⁵n = 3,649.

NOTES: Recent quitters were those who stopped smoking within the past 12 (6) months for cohorts 1 (2-4). Longer term quitters are those who stopped smoking for at least 12 (6) months for cohorts 1 (2-4). Adjusted for age, sex, marital status, education, race/ethnicity, income, chronic conditions, mode of administration, and proxy response. Letters within brackets indicate whether the subgroup in that cell differs significantly from the other 9 subgroups for the dependent variable (PCS or MCS). Least squares means for subgroups that share a letter do not differ significantly on *t*-test ($p < 0.05$) from one another.

SOURCE: The dataset links the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) cancer registry data with Medicare beneficiaries' responses to the Centers for Medicare & Medicaid Services' Medicare Health Outcomes Survey (MHOS). The linked SEER-MHOS dataset includes one survey for participants in four MHOS cohorts (baseline and followup year): 1998 and 2000; 1999 and 2001; 2000 and 2002; and 2001 and 2003. For non-cancer patients the survey is the first one they completed. For those with a cancer diagnosis, the survey is the first one completed following their cancer diagnosis.

in the time since quitting item by running regression models restricted to those in the 1st cohort (Table 4). The differences were in the same direction but not always significant due to smaller sample size.

For those without cancer, current smokers (average PCS = 41.6 and MCS = 49.9) and recent quitters (average PCS = 40.7 and MCS = 49.8) reported statistically significantly worse health than the other

Table 5

Associations of SF-36® Physical Component Summary Score (PCS) and Mental Health Component Summary Score (MCS) with Smoker Status, by Four Types of Cancer

Summary Score	Never Smoker ¹	Longer Term Quitter ²	Unsure When Quit ³	Recent Quitter ⁴	Current Smoker ⁵
SF-36® PCS					
Breast Cancer	41.4 [a]	41.4 [a]	40.9 [a, b]	41.7 [a, b]	38.9 [b]
Colorectal Cancer	41.5 [a]	40.3 [b]	40.1 [a, b]	36.7 [a, b]	40.5 [a, b]
Lung Cancer	39.1 [a]	36.4 [a]	37.8 [a]	37.7 [a]	36.5 [a]
Prostate Cancer	41.6 [a]	40.3 [b]	42.1 [a]	35.9 [c]	39.3 [b, c]
SF-36® MCS					
Breast Cancer	51.3 [a]	50.6 [a, b]	50.7 [a, b]	49.3 [a,b]	49.0 [b]
Colorectal Cancer	50.8 [a]	51.2 [a]	51.1 [a]	48.0 [a]	49.6 [a]
Lung Cancer	48.4 [a, b]	49.4 [a]	49.7 [a, b]	43.3 [b]	46.2 [b]
Prostate Cancer	50.7 [b]	51.6 [a]	50.1 [b]	50.2 [a, b]	50.0 [b]

¹n = 3,907.

²n = 4,216.

³n = 610.

⁴n = 94.

⁵n = 866.

NOTES: Recent quitters were those who stopped smoking within the past 12 (6) months for cohorts 1 (2-4). Longer term quitters are those who stopped smoking for at least 12 (6) months for cohorts 1 (2-4). Adjusted for age, sex, marital status, education, race/ethnicity, income, chronic conditions, time since diagnosis, mode of administration, cohort (1 versus 2-4) and proxy response. Letters within brackets indicate whether the subgroup in that cell differs significantly from the other four subgroups in the same row for the dependent variable (PCS or MCS). Least squares means for subgroups that share a letter do not differ significantly on *t*-test ($p < 0.05$) from one another.

SOURCE: The dataset links the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) cancer registry data with Medicare beneficiaries' responses to the Centers for Medicare & Medicaid Services' Medicare Health Outcomes Survey (MHOS). The linked SEER-MHOS dataset includes one survey for participants in four MHOS cohorts (baseline and followup year): 1998 and 2000; 1999 and 2001; 2000 and 2002; and 2001 and 2003. For non-cancer patients the survey is the first one they completed. For those with a cancer diagnosis, the survey is the first one completed following their cancer diagnosis.

groups: physical health (average PCS ranged from 42.5 to 43.0) and mental health (average MCS ranged from 51.4 to 52.5). Among those with cancer, longer term quitters and those who were unsure when they quit reported significantly better mental health than did current smokers and recent quitters (MCS of 51.1 and 50.5 versus 48.5 and 47.0, respectively). In addition, never smokers had significantly better mental health than current smokers and recent quitters.

We examined adjusted mean scores on the SF-36® PCS and MCS by smoker status separately for persons with the four major types of cancer, (1) prostate, (2) colorectal, (3) lung, and (4) breast, adjusting for time since diagnosis. As shown in Table 5, among those with breast cancer or prostate cancer, current smokers reported significantly worse physical health than never smokers. In addition, longer term quitters reported worse physical

health than never smokers for those with prostate cancer. Never smokers tended to have relatively high physical health scores for colorectal cancer and lung cancer, but these differences were not significantly different from the other groups. Mental health was significantly worse for current smokers than never smokers among those with breast cancer. Recent quitters and current smokers had significantly worse mental health than longer term quitters among those with lung cancer.

DISCUSSION

Consistent with previous research (Arday et al., 2003), this study of 123,567 Medicare beneficiaries found that current smoking was associated with statistically significant impacts on self-reported physical and mental health. Moreover, the associations of current smoking with health were similar for those with or without a diagnosis of

cancer. However, the observed differences between people with different smoking histories were not large. In fact, the largest differences were about 5 points on the *T*-score metric (0.50 SD) and several significant differences were trivial in magnitude (less than the 0.20 SD threshold for a minimally important difference).

Physical and mental health for those who recently quit smoking was similar to current smokers. The majority of the recent quitters in this study had quit smoking within the last 6 months. Medicare managed care programs that sponsor smoking cessation programs need to address the physical and psychological features of withdrawal to help recent quitters continue to refrain from smoking tobacco (U.S. Department of Health and Human Services, 1988). Achieving long-term abstinence is important because for those who quit smoking more than 15 years previously, the risk of mortality approximates that of never smokers (Ostbye and Taylor, 2004). However, smokers often quit after developing symptoms of a life-threatening disease or right after a diagnosis of cancer (U.S. Department of Health and Human Services, 1990). Hence, the association between quitting smoking and self-rated health reflects influences going in both directions.

It is important to acknowledge the limitations of this study. The cross-sectional data limits the inferences that can be drawn. A more definitive evaluation of the associations of smoking, diagnosis of cancer, and cancer type with self-reported health would require longitudinal data over an extended period of time. The measure of smoking used in this study was based on only three questions tapping lifetime use, current smoking, and time since quitting for former smokers. The time since quitting item only distinguished between less than 6 months and more than 6 months for the majority of the respondents. Greater

differentiation in time since quitting would have been useful because smoking relapse is prevalent beyond 6 months. In addition, comorbidity was self-reported. However, data comparing MHOS self-reports of chronic conditions reveals good correspondence with medical records (Miller et al. 2003).

Because smokers have a higher mortality rate than nonsmokers (U.S. Department of Health and Human Services, 1990), those with a history of smoking in this study may represent a healthier group of survivors. This selection effect could suggest a more positive picture of health for smokers than would otherwise be the case and could contribute to the relatively small effect sizes observed here and in other studies. Future research should consider using a preference-based health measure (Fryback et al., 2007) with 0 assigned to those who are dead (i.e., the scale is anchored by 0 representing being as bad as being dead). Providing mortality information would yield a more comprehensive comparison of groups, but a preference measure has the advantage of being a unified summary of morbidity and mortality. This may present compelling information for Medicare Advantage plans that are deciding how to allocate scarce resources among alternative interventional opportunities designed to improve the health of Medicare beneficiaries enrolled in their plan.

Future studies are also needed to better understand the relatively poor self-rated health of recent quitters to identify the longitudinal trajectory of the physiological and psychological symptoms of smoking cessation and its relationship to health perceptions. In tandem with this work is the need to determine the best strategies for supporting those who recently quit smoking in order for them to maintain abstinence and achieve the positive health effects of longer term quitters. The cost effectiveness of

different smoking cessation interventions is an important area for future research (Tran et al., 2002).

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