The Economic Cost of Squamous Cell Cancer of the Head and Neck

Findings From Linked SEER-Medicare Data

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Objective: To evaluate the excess mortality, resource use, and costs associated with squamous cell carcinoma of the head and neck (SCCHN) among elderly Medicare beneficiaries.

Design: Retrospective cohort analysis using data from the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute and Medicare claims.

Subjects: Study cohorts included patients aged 65 years and older who were newly diagnosed as having SCCHN in a SEER registry between 1991 and 1993 (N = 4536) and controls matched 1:1 by age and sex. Patients were followed up for 5 years or until death, whichever occurred first.

Results: Initial treatment was primarily surgery and/or radiation among patients with early-stage SCCHN, with only modest use of chemotherapy. Patients with SCCHN had significantly (P<.001) higher 5-year mortality (64% vs 25%) and health care costs than controls. Average Medicare payments (1998 US dollars) among patients with SCCHN were $25542 higher than those of matched comparison patients (P<.001), with monthly payments 3 times as high ($1428 vs $446). Patients diagnosed as having advanced SCCHN had shorter survival times (5-year mortality, 85%, 75%, 47%, and 35% among patients diagnosed as having distant, regional, local, and in situ cancer, respectively) and higher costs (average total Medicare payments, $53741, $58387, $42698, and $37434, respectively).

Conclusion: These results suggest that the health economic burden of SCCHN is substantial, with costs that are comparable with or higher than those of other solid tumors.

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End Results (SEER) Program cancer registries and Medicare claims data to (1) evaluate initial treatment practices for patients with SCCHN; (2) assess the excess mortality, resource use, and medical costs associated with SCCHN among elderly Medicare beneficiaries; and (3) explore the relationship between cancer stage at diagnosis and these outcomes. These data have been used previously to compare survival among US and Canadian patients with cancers of the upper aerodigestive tract, and to compare the treatment of patients with glottic cancer in the United States and Canada.8

DATA SOURCE

The analysis linked clinical data from the SEER Program of the National Cancer Institute and Medicare claims. The SEER-Medicare database is a collaborative effort of the National Cancer Institute, the SEER registries, and the Centers for Medicare and Medicaid Services (CMS). SEER is an epidemiologic surveillance system consisting of 11 population-based tumor registries designed to track cancer incidence and survival in the United States. The registries routinely collect information on patients with newly diagnosed cancer in geographically defined areas that represent approximately 14% of the US population. The registries ascertain all newly diagnosed cancer cases from multiple reporting sources.22

The linked data include a SEER data file as well as Medicare claims covering the period from 1991 through 1998. The SEER file includes demographics (eg, age, sex, race, date of death); SEER diagnostic information for up to 10 different incident cancer cases for each person, including date of cancer diagnosis, cancer site/type (eg, oral cavity, pharynx), and cancer stage at diagnosis (ie, in situ, local, regional, distant, unstaged); and indicators for surgery and radiation in the 4 months after diagnosis. The Medicare claims files include enrollment data (eg, health maintenance organization [HMO] enrollment, months of Part A and/or Part B eligibility) and details on inpatient, outpatient, physician, home health, hospice, and skilled nursing facility utilization, including dates of service (for calculating length of hospitalization), type of service (eg, inpatient, skilled nursing facility, outpatient clinic, hospice, home health, or physician), International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) (sixth edition) diagnosis codes (up to 10), ICD-9-CM procedure codes (up to 10), diagnosis related group (1 in inpatient file), Healthcare Common Procedure Coding System codes (1 in outpatient and physician files), and Medicare payment amounts. Combining the SEER and Medicare data provided us with information on both the initial diagnosis and later cancer treatment, as well as the downstream medical care for patients with cancer.

COHORT SELECTION

Two mutually exclusive groups were selected for inclusion in the analysis and followed up for 5 years or until death, whichever occurred first: patients with a diagnosis consistent with SCCHN (SCCHN cohort) and those without any such diagnosis (comparison cohort).

SCCHN Cohort

All patients aged 65 years and older with a new diagnosis of SCCHN reported to a SEER registry between January 1991 and December 1993 (with no evidence of previous cancer) were selected for inclusion in the SCCHN cohort. The diagnosis of SCCHN included cancers of the oral cavity and pharynx (ie, lip, tongue, salivary gland, floor of mouth, gum, nasopharynx, tonsil, oropharynx, and hypopharynx) and cancers of the nasal cavity and larynx, as identified through the SEER site code variable (values 1-10, 37, and 38). Patients enrolled in HMOs and those not eligible for Part A and Part B Medicare benefits at any time during the 5 years after diagnosis were excluded from the analyses because complete claims may not have been available for them. Because only the month and year of SCCHN diagnosis were available in the SEER data file, the index date was defined by means of the first day of the month of diagnosis (eg, a person diagnosed in January of 1991 was assigned an index date of January 1, 1991), so as not to miss any health care utilization claims surrounding diagnosis.

Comparison Cohort

For comparison purposes, an age- and sex-matched comparison cohort without cancer was selected from Medicare enrollment files by using a 5% sample of Medicare beneficiaries residing in SEER areas. From this pool, one patient of the same age and sex was randomly selected and matched to each patient with SCCHN and was assigned the same index date as the matched patient with SCCHN. Patients in the comparison cohort were not required to have used services to be selected for inclusion and could develop cancers other than SCCHN after their index date. However, as in the SCCHN group, patients enrolled in HMOs and those not eligible for Part A and Part B Medicare benefits during the study period were not eligible for inclusion in the comparison cohort.

STUDY MEASURES

For the SCCHN cohort only, the use of surgery and/or radiotherapy as initial treatment was identified on the basis of data from the SEER file supplemented by selected diagnosis related groups, ICD-9-CM diagnosis and procedure codes, and Healthcare Common Procedure Coding System codes in the Medicare claims data. Initial surgery and radiation treatment were defined during the first 4 months after diagnosis, consistent with the reporting period for the SEER data. In addition, the use of Medicare-covered chemotherapy was assessed during the initial period by means of diagnosis related groups, ICD-9-CM procedure codes, and Healthcare Common Procedure Coding System codes in the Medicare claims data. Treatments received beyond 4 months after diagnosis were not evaluated.

Differences in outcomes between the cohorts were considered attributable to SCCHN. Survival was evaluated from the index date during a period of 5 years in terms of the percentage of patients alive in each month after SCCHN diagnosis as well as the median number of months of survival. Health care resource use for all causes was evaluated in terms of the percentage of patients hospitalized and the percentages who received skilled nursing care, outpatient hospital or clinic care, hospice care, home health care, and physician or medical services during 5 years. Total hospital and skilled nursing facility days also were tabulated. Medicare payments were evaluated overall (calculated as the sum of payments for hospital, skilled nursing, home health, hospice, outpatient, and physician services) as well as by individual category of care. To account for differences in follow-up between cohorts, costs also were evaluated on a monthly basis. All payments were converted to 1998 dollars by means of the medical care component of the Consumer Price Index.
STATISTICAL ANALYSIS

Initial treatment among patients with SCCHN was evaluated during the first 4 months of follow-up (eg, surgery, chemotherapy, or radiotherapy). Kaplan-Meier survival curves were generated for each cohort. To account for the matched design in comparisons between study cohorts, paired-sample statistical techniques were used to test the significance of differences in outcomes (ie, McNemar test for differences in 5-year mortality and the proportions using various services, and the Wilcoxon rank-sum test for differences in levels of resource use and Medicare payments, which were not normally distributed). Differences were analyzed overall, as well as stratified by year of follow-up, age, sex, race, region, metropolitan residence, comorbidity, and development of cancer subsequent to study entry. In addition, multivariate analyses based on analysis of variance techniques were undertaken to estimate the impact of potentially confounding influences on study outcomes. These included multiple linear regressions for continuous measures (eg, natural logarithms of hospital days, Medicare payments) and a logistic regression for survival. These models controlled for race, non–cancer-related comorbidity, development of other cancers subsequent to study entry, geographic region, metropolitan residence, and duration of follow-up. Comorbidity was defined during the entire study period by means of the Deyo et al adaptation of the Charlson comorbidity index, which involved creating 17 binary variables to indicate the presence of ICD-9-CM codes representing 17 comorbid conditions, and scoring those conditions to create a single comorbidity index. Comorbidities related to SCCHN (ie, malignancy, solid tumors, chronic pulmonary disease) were excluded from the index. Since findings did not differ on the basis of multivariate analyses, those results are not reported herein. Finally, study measures were analyzed by cancer stage (excluding unstaged patients) among patients within the SCCHN cohort to aid in understanding the drivers behind resource use and costs within the cohort.

RESULTS

PATIENT CHARACTERISTICS

From an initial sample of 6592 Medicare beneficiaries 65 years and older with a diagnosis of SCCHN between 1991 and 1993, approximately 30% of patients (n = 2056) were excluded. The reasons included enrollment in an HMO (n = 1463), missing diagnosis dates or claims details (n = 350), and lack of entitlement to Medicare benefits during the study period (n = 243). This left a total of 4536 Medicare beneficiaries 65 years and older with an initial diagnosis of SCCHN in a SEER registry between January 1, 1991, and December 31, 1993, for inclusion in the SCCHN cohort. An age- and sex-matched comparison cohort of 4536 Medicare enrollees was also selected randomly from among those residing in the SEER areas who had no evidence of cancer and who had the same HMO and eligibility status as their respective SCCHN matches.

Patients in the SCCHN cohort were evenly distributed by year of diagnosis. The majority of patients (66%) had cancer of the oral cavity and pharynx (ie, 19% mouth or gums, 13% tongue, 11% pharynx, 9% lip, 7% salivary gland, 5% tonsil, and 2% other), while 29% had cancer of the larynx and 5% had cancer of the nose or nasal cavity. With respect to disease stage, most patients were diagnosed as having local (37%) or regional (34%) cancer. Approximately 10% of patients were diagnosed as having distant cancer, 4% in situ cancer, and the remaining 16% unstaged cancer.

The average age among patients in both cohorts was 74 years, and 34% of patients in each cohort were female (Table 1), as these were the matching variables.
Approximately 82% of patients with SCCHN were hospitalized during the 5-year follow-up period, compared with 55% of the comparison cohort \( (P < .001) \), for an average of 2.3 vs 1.4 hospitalizations, respectively \( (P < .001) \). The corresponding mean ± SD numbers of inpatient days were 24 ± 29 and 12 ± 27 days \( (P < .001) \). Approximately 22% of patients with SCCHN received care in a skilled nursing facility, compared with 13% of comparison patients \( (P < .001) \), for an average of 9 vs 5 days, respectively \( (P < .001) \). The levels of use of outpatient hospital and physician services also were higher in the SCCHN cohort. Finally, large differences in the use of home health and hospice care were detected, with approximately 48% of patients with SCCHN receiving home care and 14% receiving hospice care, compared with 26% and 3% among comparison patients (both \( P < .001) \).

Reflecting differences in resource use, mean and median Medicare expenditures in the SCCHN cohort averaged approximately $25,000 higher than those for the comparison group (mean ± SD, $48,847 ± $47,999 vs $23,305 ± $33,425; median, $36,482 vs $10,550; \( P < .001 \)). This difference was driven primarily by the $13,821 difference in hospital payments ($257,11 ± $33,821 vs $118,90 ± $21,334; median, $158,51 vs $33,52; \( P < .001 \)). On a monthly basis, differences between cohorts also were large, with average Medicare payments of $1,428 per month of follow-up among patients with SCCHN vs $446 per month of follow-up for the comparison group \( (P < .001) \). More than 85% of the total difference in payments between cohorts was incurred in the first year of follow-up (Figure 2). Even among patients who survived at least 5 years, 85% of the difference in costs was incurred in the first year, with cost differences leveling off by the fifth year.

In stratified analyses, differences in outcomes between the cohorts were similar on the basis of sex, race, geographic region, and residence in a metropolitan area, with patients with SCCHN consistently having lower survival and higher costs. Differences were somewhat narrower among the oldest patients ($21,313 vs $58,341 among the youngest patients) and those with the highest Charlson comorbidity index scores ($10,702 vs $51,699 among those with the lowest scores), reflecting higher mortality in general among older and sicker patients, regardless of whether they had SCCHN.

Excluding patients who developed other cancers after study entry had no substantive impact on findings.
Finally, within the SCCHN cohort, outcomes by cancer site were generally similar.

OUTCOMES BY CANCER STAGE WITHIN THE SCCHN COHORT

Patients diagnosed as having SCCHN in the advanced stages of disease had the highest 5-year mortality (85% among patients with distant cancer vs 75% among those with regional cancer, 47% among those with local cancer, and 35% among those with in situ cancer). Despite their shorter follow-up, resource use and costs were highest among patients with the most advanced disease. For example, patients with distant cancer spent an average of 30 days in the hospital compared with an average of 16 for those diagnosed as having in situ cancer. Similar differences were noted in the use of home health care (56% among patients with distant disease vs 37% among patients with in situ cancer) and hospice services (22% and 8%, respectively).

Reflecting these differences in resource utilization, there were substantial differences across disease stages in Medicare payments (Figure 3). Patients diagnosed as having regional and distant cancer had the highest average total Medicare expenditures during 5 years ($58,387 and $53,741, respectively), while those diagnosed as having in situ and localized cancer had the lowest expenditures ($37,434 and $42,698, respectively). Within each stage, patients with the highest comorbidity scores had costs that were more than 2 times those of patients with the lowest comorbidity scores. On an average monthly basis, thereby controlling for survival time, differences by stage were even more striking, with average monthly payments of $747 per month of follow-up among patients diagnosed as having in situ cancer, $968 for patients with localized cancer, $2059 for patients with regional cancer, and $2547 among patients with distant-staged cancer.

Table 3. Medicare Payments Among Patients With SCCHN and Matched Control Patients*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Patients With SCCHN (n = 4536), $</th>
<th>Matched Control Patients (n = 4536), $</th>
<th>Difference, $</th>
<th>P Value</th>
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<td>Hospital payments</td>
<td></td>
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<tr>
<td>Mean (SD)</td>
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<td>11,890 (21,334)</td>
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<td>Median</td>
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<tr>
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<td>Skilled nursing facility payments</td>
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</tr>
<tr>
<td>Mean (SD)</td>
<td>2,235 (6617)</td>
<td>1,315 (4,896)</td>
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<tr>
<td>Median</td>
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<td>0</td>
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<tr>
<td>IQR range</td>
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<td>Outpatient hospital/clinic payments</td>
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<tr>
<td>Mean (SD)</td>
<td>5,255 (6219)</td>
<td>1,987 (5,751)</td>
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<td>IQR range</td>
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<td>Physician payments</td>
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<td>Mean (SD)</td>
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<td>Home health payments</td>
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<tr>
<td>Mean (SD)</td>
<td>2,595 (7,564)</td>
<td>1,765 (7,496)</td>
<td>830</td>
<td>&lt;.001</td>
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<tr>
<td>Median</td>
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<td></td>
</tr>
<tr>
<td>IQR range</td>
<td>0-2,205</td>
<td>0-218</td>
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<tr>
<td>Hospice payments</td>
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<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>899 (4,234)</td>
<td>120 (1,126)</td>
<td>779</td>
<td>&lt;.001</td>
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<tr>
<td>Median</td>
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<tr>
<td>IQR range</td>
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<td>0-0</td>
<td></td>
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<tr>
<td>Total Medicare payments</td>
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<tr>
<td>Mean (SD)</td>
<td>48,847 (47,999)</td>
<td>23,305 (33,425)</td>
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<tr>
<td>Median</td>
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<tr>
<td>IQR range</td>
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<td>2,782-31,119</td>
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<tr>
<td>Total Medicare payments per month of follow-up</td>
<td>1,428</td>
<td>446</td>
<td>982</td>
<td></td>
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Abbreviations: IQR, interquartile; SCCHN, squamous cell carcinoma of the head and neck.
*Values are in 1998 US dollars.

Figure 2. Medicare payments among patients with squamous cell carcinoma of the head and neck (SCCHN) and matched control patients, by year of follow-up (1998 US dollars). All patients were followed up for 5 years; patients who died during follow-up were assigned zero costs in the years after death (from Surveillance, Epidemiology, and End Results [SEER] Program–Medicare data, 1991-1998).
This study examined mortality and longitudinal Medicare cost data among a large population-based cohort of elderly patients with SCCHN. Our findings are similar to those from other studies of survival among patients with SCCHN, as well as results from studies of other cancers, which have indicated that health care costs among patients with cancer are dominated by hospitalization costs. Our estimate of the annual excess cost attributable to SCCHN (approximately $12,000) ranks at the upper end of the range of excess cost estimates (in 1998 dollars) for other solid tumors, with lung and ovarian cancer having higher annual excess costs ($13,000-$14,000), and breast, prostate, colon, and rectum cancer having lower annual excess costs (ranging from $5,000-$9,000).

Initial treatment among patients with SCCHN in our study was primarily surgery and/or radiation, with only modest use of chemotherapy. While there is inconclusive evidence that chemotherapy prolongs survival among patients with advanced SCCHN, its role may be expanding given some evidence of modest benefits when used in combination with radiation for localized disease. Recent and ongoing clinical trials to assess the combined use of chemotherapy and other new targeted anticancer treatments will be of use in shaping a future role for chemotherapy for this disease.

It is interesting that the use of hospice care was relatively uncommon (14% of all patients with SCCHN), even among decedents in their last 6 months of life (22%), despite the fact that Medicare hospice program costs have more than doubled in the past decade. This level of hospice use is in the range observed in several other studies among terminal patients.

While a complete analysis of the excess burden of SCCHN to the Medicare program is beyond the scope of this study, we expect it to be substantial. During our period of analysis (1991 to 1993), approximately 15,600 patients were diagnosed as having SCCHN in a SEER registry each year. Since SEER covers approximately 14% of cancer cases in the United States, we would expect approximately 10,000 elderly Medicare patients to be diagnosed as having SCCHN in the United States each year. On this basis, the expected excess burden to Medicare for incident cases of SCCHN in a given year followed for up to 5 years would be more than $250 million.

Our study is subject to several limitations. First, we relied on administrative claims data, which are not collected specifically for research purposes and have known limitations, to assess chemotherapy use and health care costs since these were unavailable in the SEER registry data. As a result, we were able to observe only Medicare-covered chemotherapy (ie, we could not observe oral medications). However, because most chemotherapy regimens for SCCHN are parenteral, we do not expect this to have greatly affected our results. In addition, SEER-Medicare files do not allow cancer outcomes, such as remission rates, disease-free survival, and quality of life, to be assessed. Furthermore, patients from SEER registries may not be representative of all US patients with SCCHN. While SEER data cover about 14% of all cancer cases, certain groups are underrepresented or overrepresented (eg, African Americans and other races, respectively). Nonetheless, the linked SEER-Medicare database has proved extremely useful for case selection and profiling oncology treatment patterns and survival for many different cancer types, including cancers of the lungs, ovaries, breast, prostate, colon, and rectum and acute myeloid leukemia. While both individual data sources have their limitations, together they have the enormous advantages of broad population-based coverage over multiple years and accessibility.

Costs were evaluated from a limited perspective (ie, single payer) and in a limited population (ie, patients 65 years and older who were Medicare-eligible and not in HMOs). Because our interest was in the elderly, most of whom are eligible for Medicare, we expect that the bulk of costs among elderly patients were captured in our analysis. Furthermore, the percentage of patients excluded because of HMO enrollment (20%) was consistent with HMO penetration in the United States (15%). Since the excluded patients were similar to the study population, their exclusion is not likely to have affected our results. Finally, it is possible that differences in outcomes between the cohorts were due at least partly to unobserved differences in socioeconomic status between study groups. However, because most comparison group patients (76%) were from the same ZIP code areas as patients with SCCHN, we believe it is unlikely that socioeconomic factors influenced outcomes.

This study suggests that the health economic burden of SCCHN to the Medicare program is substantial, with annual excess costs that are comparable with or higher than those of other solid tumors.

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REFERENCES


