Inpatient Oncology Length of Stay and Hospital Costs: Implications for Rising Inpatient Expenditures

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ABSTRACT

Background: Cancer, which has consistently been a top five cause of death among the American public, consumes a large proportion of healthcare dollars. No literature exists documenting how the economic aspects of inpatient cancer care compare to those of other hospitalized patients.

Objective: This study was designed to measure the demographics, cost, and outcomes of oncology inpatients (cases) and compare them to non-oncology inpatients (controls).

Research Design: A retrospective case-control study from October 1, 2002 through September 30, 2003 was undertaken using a medical cost accounting database from a large tertiary care hospital. Age, race, case mix index (CMI), insurance status, length of stay (LOS), cost, and discharge status were compared between cases and controls.

Results: Compared to controls, cancer patients (n=1044) had a significantly higher average CMI ($P<0.002$) and a longer median LOS (5 vs. 4 days, $P<0.001$). Compared to controls, cancer patients utilized hospice services (2.8% vs. 0.3%; $P<0.05$) or expired more frequently (8.9% vs. 3.6%; $P<0.05$). Total hospital costs, medication costs, and surgery costs were higher for oncology patients compared to non-oncology controls ($P<0.001$), however, radiology and laboratory costs were significantly less costly compared to controls ($P<0.05$).

Conclusions: This is the first study to report on the demographics, length of stay, and costs of cancer inpatients. A comparison to non-oncology controls demonstrates the resources utilized in providing medical care to oncology patients. Cost-containment measures could have a significant impact on hospital resources spent in patients with cancer.

INTRODUCTION

According to a recent publication from the Department of Epidemiology and Surveillance Research, cancer is the second leading cause of morbidity and mortality in the United States, ranking just below heart disease.[1] Specifically, cancer accounts for 23%, or nearly 1 in 4, of all deaths in the US. For those younger than 85 years of age, cancer is the number one cause of death.

Generally, most cancer patients, especially those with hematologic neoplasms, will require hospitalization at some point during the course of their disease, either for surgery to excise primary or metastatic disease; chemotherapy for adjuvant or palliative therapy; or for supportive care for complications of the disease and/or its treatment, such as febrile neutropenia or tumor lysis syndrome. Additionally, with the recent implementation of the Medicare Management Act (MMA), a growing number of patients that may have previously been treated at an outpatient center are now admitted to hospital due to the reduced reimbursement, and thus, decreased revenue for the outpatient center.

Antineoplastic drugs, as a class, continue to contribute to the growing hospital pharmacy drug expenditures. For example, in a recent analysis by Hoffman and colleagues, antineoplastic drug spending accounted for 10% of the total 2004 hospital expenditures, totaling $2,581,121,000 for nonfederal hospitals.[2] Of the top 15 hospital drug expenditures, one was an antineoplastic agent (rituximab) and five were oncology-related supportive care agents (epoetin alfa, darbeopoetin, pegfilgrastim, ondansetron, and filgrastim). As additional targeted therapies are approved by the Food and Drug Administration for the treatment of cancer, drug expenditures for oncology inpatients will only continue to increase.

Because cancer patients require multi-modality treatment, an examination of inpatient economic data is important. Currently, no published literature exists summarizing the total direct hospital costs and length of stay for all cancer inpatients. Furthermore, while multiple studies analyzing costs and outcomes have been conducted in other therapeutic areas or in specific subsets of cancer, no studies have evaluated oncology diagnoses and compared results to other diagnoses groups. The purpose of this study was to compare the demographics, cost, and outcomes of oncology inpatients to all other inpatients admitted during the same timeframe at a large, private, community hospital located in the south central region of the United States.

METHODS

This was a retrospective cohort study of all patients admitted to Baptist Memorial Health Care corporation hospitals in Tennessee over a 12-month period (October 1, 2002 through September 30, 2003). Patients under the age of 18 years were excluded from the analysis. Data analysis was conducted with a relational database (Microsoft Access 2000, Seattle, WA) and Statisti-XL (version 1.6, Kalamunda, Western Australia) was utilized for statistical analysis.

Cost data was extracted from a hospital cost accounting database. Diagnoses were obtained from an aggregated Diagnosis Related Group (DRG) coding system (Medicode-DRG Expert, Reston, VA). DRGs are used by Medicare and other third-party payers to classify inpatient hospital services based on the principal diagnosis, any secondary diagnoses, demographics, presence of complications, and surgical procedures. Patients had a minimum of one diagnosis code and a maximum of fifteen. Patients with a diagnosis within

Table 1. Cost Summary for Cancer Inpatients vs. Control Inpatients

	Cancer Patients Costs ($) (n=1015)	Control Patients Costs ($) (n=15,347)	*P*-value
Total	6,923 (258-162,595)	5,440 (88-435,382)	<0.0001
Medication	479 (0-24,829)	334 (0-79,478)	<0.0001
Laboratory	117 (0-10,848)	134 (0-37,516)	0.049
Radiology	58 (0-9,562)	135 (0-40,072)	<0.0001
Surgery	781 (0-31,289)	0 (0-107,751)	<0.0001
Respiratory	0 (0-4,909)	0 (0-21,948)	0.06
OT/PT	0 (0-7,198)	0 (0-4,282)	0.22

All cost shown as median (range)
OT=occupational therapy; PT=physical therapy

the medical diagnosis category of neoplasm (ICD-9 codes 140-209 and 230-239.9) were selected as the cases and compared to all other diagnoses (controls). Patients with benign neoplasms, a less severe, non-malignant disease, were excluded because of the potential to bias the results. Age, race, length of stay (LOS), case mix index (CMI), costs (total, medication, laboratory, radiology, physical/occupational therapy, respiratory, and surgery costs), and discharge status (home, continued care, expired, or hospice) were compared between cases and controls. CMI is a tool that illustrates the severity of a patient population and can be used to compare the severity of illness between DRGs. The higher the CMI, the more severely ill that particular patient population is.

To compare continuous, non-normal data (ie, hospital cost and LOS) between cancer patients and controls, a Mann-Whitney *U* test was utilized. For continuous data with a normal distribution (ie, race and CMI), a Student's *t*-test was used. Finally, a Chi-Square analysis was used for nominal data (ie, discharge status). A *P*-value <0.05 was considered statistically significant. This study was granted exemption from the hospital's Institutional Review Board (IRB).

RESULTS

Cancer patients (n=1,044) represented 6.8% of persons admitted to the hospital. Compared to all other diagnosis categories (n=15,347), cancer patients were older (mean 64.4 years ± 12.9 for cancer patients vs. 62.4 ± 16.7 for others; *P*<0.001) and they had a significantly higher CMI than the control patients (1.9 ± 1.6 vs. 1.7 ± 1.8, respectively; *P*=0.0025) when compared to controls. Table 1 describes differences in hospitalization costs. Total hospital, medication, and surgery costs were significantly higher in the oncology group. However, radiology and laboratory costs were significantly higher in controls (*P*<0.0001). Respiratory and physical/occupational therapy costs were not statistically significant. Cancer patients had a significantly longer LOS compared to all other diagnoses (median: 5 days [range: 1-103 days] vs. median: 4 days [range: 1-336 days], *P*<0.0001, respectively), but no differences in intensive care unit (ICU) LOS were observed between groups (median: 0 days [range: 0-40 days] vs. 0 days [range: 0-81 days], *P*=0.45).

Discharge status analyses demonstrated that cancer patients were discharged home less frequently (73.1%) than controls (77.7%), and utilized hos-

pice services more frequently (2.8% vs. 0.3%, respectively). Interestingly, control patients required continuing health services after discharge more frequently than oncology patients (17.8% vs. 15.0%, respectively). Compared to other diagnoses, cancer patients died in the hospital more frequently (8.9%) than non-oncology patients (3.6%) ($P<0.0001$ for all).

DISCUSSION

This retrospective review found that, although cancer patients only made up 6.8% of the inpatient status at this community hospital in the 2003 fiscal year, the total costs in caring for these patients were 30% higher compared to non-oncology patients (an absolute difference of $1,483 per patient). Since this analysis was completed before the enactment of the Medicare Modernization Act, it would be expected that current and future demographic analyses would demonstrate a larger oncology inpatient make-up. The greater cost shown in our study was mainly attributed to the greater medication costs and surgery costs incurred by cancer patients compared to non-oncology patients (Table 1). These results are not surprising, based on the multi-modality nature of oncology treatment and the medical oncologic emergencies that can arise.

Since cancer patients had greater total costs compared to controls, it is not unexpected that cancer patients had a longer LOS and a greater CMI. Only 26% of non-oncology patients were hospitalized for longer than 7 days compared to 36% of oncology patients. At 14 days, only 9% of non-oncology patients remained in the hospital compared to 15% of cancer patients. As expected, a greater proportion of oncology inpatients died or required hospice care reflecting the greater CMI and non-curative disease state of this patient population. However, there was no significant difference in the ICU LOS between oncology cases and controls.

Most information available on oncology costs in the medical literature focuses on the costs of a specific neoplasm, treatment, or procedure. Our study is unique in that it evaluates economic and health outcomes of all oncology inpatients compared to controls to allow for an evaluation of future distribution of hospital resources. A study by van Agthoven and colleagues sought to determine the total cost of cancer care (ie, direct and indirect costs associated with healthcare and direct and indirect costs associated outside of healthcare) in 854 patients with head and neck cancer in the Netherlands.[3] The authors found that the average total costs were €31,829 (approximately $40,779) and quality improvement measures could decrease the cost of care by €1,598 (approximately $2,047). Unlike our study, van Agthoven et al[3] determined costs for up to 10 years following diagnosis, making a cost comparison of direct hospital costs difficult. Additionally, they did not break costs down based on services provided to patients, such as laboratory and surgery.

Dedes and colleagues demonstrated that hospital cost accounted for the majority of the total costs incurred in the medical care of lung cancer patients.[4] In this study, 118 lung cancer patients (89% non-small cell and 11% small cell) admitted to the University Hospital of Zurich during a 1-year period were followed for the purpose of examining total costs associated with medical care. The investigators found that 71% of the total cost per patient was incurred during hospitalization with a median total cost of inpatient and outpatient care of €14,691, range €1,821-80,020 (approximately $18,822, $2,333-$102,521). Patients with advanced disease had the greatest total costs, attributed to the cost of chemotherapy.

Another analysis focused specifically on hospital costs in 253 lung cancer patients (90% non-small cell and 10% small cell) treated in the United Kingdom.[5] The authors found a large variance in patient care and follow-up. On average, hospital costs accounted for 76-80% of the total cost of care for these patients. Length of stay and cost were categorized based on the purpose of hospitalization (eg, diagnosis, surgery, inpatient palliative care, etc). However, similar to van Agthoven,[3] a complete cost breakdown was not available per patient.

The methodology of the above mentioned studies varied vastly when compared to our study. In our study, we calculated data from actual hospital costs in all patients with neoplasms whereas the prior studies utilized hospital charges or were from direct observation of consumed health care resources in a specific type of cancer. Also, the other studies included outpatient cost where our study focused on inpatient cost. These reasons may account for the differences in cost between studies. Hospital costs provide practitioners with a better representation of consumed resources when compared to inflated hospital charges, which include overhead charges. Hospitals rarely receive the full balance of the hospital charges. Additionally, information on costs from other countries may not be applicable to the United States patient population because of the drastic difference in health care systems.

Another difference in methodology was the selection of populations. None of the prior studies compared the expenditures in oncology patients to those with non-oncology diagnoses and all focused on a single type of cancerous state. Since diseases such as head and neck cancer and lung cancer actually compromise several cancerous disease states with vastly different treatment standards, selecting these patient groups to focus on is not always useful to gain an understanding of total cost of care.

However, several limitations need to be considered when analyzing these results. First, this retrospective review included evaluation of a health system claims database. These databases are likely to contain miscoding and/or be incomplete for demographic information. For example, in a previous study we completed an analysis of racial disparities in inpatient neutropenic cancer patients, a very small portion of neutropenic patients (coded as agranulocytosis ICD-9 288.0) were also coded as having a fever, as defined by ICD-9 diagnoses.[6] However, based on the large number of patients who received at least one dose of an anti-infective, it can be assumed that more patients presented with febrile neutropenia than noted in the database.

Second, our database allows a maximum of 15 diagnoses per hospitalization. However, the primary diagnosis listed is frequently the most expensive diagnosis and not necessarily the most life threatening. Both of these factors make it difficult to match patient groups. Finally, we have limited abilities to link medication costs with the types of medication used. Since the cancer inpatients had a significantly higher median medication costs, it would have been interesting to see if chemotherapy or supportive care medications accounted for this increase.

CONCLUSION

Patients hospitalized with a primary diagnosis of cancer have a higher severity of illness, longer length of stay, greater hospital costs, and poorer outcomes than those of non-oncology controls. Utilizing cost-effective therapy, decreasing length of stay, and decreasing morbidity and mortality could have a significant impact on hospital resources spent on patients with cancer. The recent changes in MMA have the potential to increase

hospitalizations in oncology patients. This potential for increased hospitalizations makes cost containment an important issue for healthcare facilities across the nation.

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