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Mean direct medical care costs associated with cervical cancer for commercially insured patients in Texas

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HIGHLIGHTS

- Mean first year cost of new cervical cancer cases in Texas was $50,846.
- Mean second year cost of cervical cancer cases was $27,656.
- Cost declined steeply between month 1 and month 5 after diagnosis.
- Cost associated with co-morbidities and residing in west Texas.

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ABSTRACT

Objective. To determine the mean cervical cancer medical care costs for patients enrolled in commercial insurance in Texas. Cost is represented by insurer and patient payments for care.

Methods. We estimated the mean medical care costs during the first 2 years after the index diagnosis date for patients with cervical cancer (cases). Cases were identified using claims-based International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9), diagnosis codes and matched to controls without a claims-based ICD-9 code for cancer using a 2-step propensity score matching method. Index dates for the cases were randomly assigned to potential controls, and cases and controls were matched by index date. Data for cancer cases and controls were obtained from the de-identified 2011–2014 U.S. MarketScan databases. A generalized linear model was employed to compute the cost for censored months during the 2-year follow-up period. Differential costs were assessed by subtracting the medical costs incurred by controls from those incurred by cases.

Results. During 2011–2014, 475 commercially insured Texas patients with newly diagnosed cervical cancer met the inclusion criteria. The first-year and second-year mean medical costs were $60,828 and $37,721 for cases and $9982 and $10,066 for controls, respectively. The differential costs of cervical cancer for the first and second years were $50,846 and $27,656, respectively. The major correlates of higher monthly cervical cancer costs were higher Charlson Comorbidity Index score during 6 months period prior to diagnosis, higher healthcare costs between 6 months and 3 months prior to diagnosis, and residence in the western region of Texas. Costs for cervical cancer patients decreased steeply between month 1 and month 5 after diagnosis and then were stable, while costs for the control group were stable throughout the follow-up period.

Conclusions. Mean direct medical costs associated with cervical cancer in Texas were substantial. These data will serve as key cost parameters in models of costs associated with human papillomavirus (HPV)-related cancers in Texas and the economic evaluation of HPV vaccination dissemination in Texas.

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1. Introduction

Human papillomavirus (HPV)-related cervical cancer continues to cause serious health and economic consequences despite the fact that both cervical cancer screening and HPV vaccination are available and covered by public and private insurance programs. From 2008 to 2012, the average annual number of new cases of HPV-associated cancers of the cervix in the United States was 11,771, and an estimated 90.6% of cases were attributable to HPV [1]. In Texas in 2015, there were about 1112 new cases of HPV-related cervical cancer, and over 390 deaths were attributed to the disease [2]. Texas is among the states with the highest cervical cancer incidence rates, reporting an age-adjusted incidence of 8.7 per 100,000 population in 2013, compared with a rate of 7.2 per 100,000 population in the US women. Cervical cancer age-adjusted death rate for Texas was 2.7 per 100,000 population, higher than the national rate of 2.3 per 100,000 population [3]. Of all HPV-related cancers, cervical cancer is the one associated with the highest direct treatment costs in the United States [4]: an estimated $441 million annually in 2010 U.S. dollars. Texas state Medicaid payments for all acute care for cervical cancer totaled $8.4 million in 2014 [5]. The HPV immunization rate is relatively low in Texas, with about 40% of girls and 24% of boys completing full vaccination series [6]. Given limited resources, it is important to consider the potential benefits of HPV vaccination initiatives designed to reduce cervical cancer in Texas.

The leading economic decision analytic models of HPV immunization rely on earlier cost estimates for cervical cancer treatment [7–10]. Those earlier cost estimates are from the 1990s and are based on limited numbers of patients from a single health maintenance organization in the northwest United States; therefore, they are not generalizable to cervical cancer treatment in Texas today.

The primary aim of this study was to estimate the mean first-year costs of treating new cases of cervical cancer in Texas. Cost is represented by insurer and patient payments for care. Additional aims were to estimate the mean 2-year cervical cancer treatment costs in Texas and examine the insurance, demographic, and comorbidity correlates of cervical cancer treatment costs in the state. In future work, these results can be used together with cost estimates for uninsured and publicly insured groups to model the expected total statewide costs of cervical cancer in Texas with and without increases in HPV immunization rates.

2. Methods

2.1. Data sources

We identified Texas women with cervical cancer from the de-identified 2011–2014 U.S. MarketScan databases. The databases had between 160 and 206 million enrollees per year during the study period, of whom 92% were insured through a commercial plan and 8% were enrolled in the Medicare supplemental plan. Information on demographics, diagnosis, enrollment duration, and inpatient, outpatient, and pharmacy healthcare utilization and costs was extracted from the databases.

2.2. Study population

Cervical cancer cases were identified from healthcare claims covering the period from January 1, 2011, to December 31, 2014. To qualify as an incident case, a woman had to 1) have either 1 inpatient claim or 2 outpatient claims at least 30 days apart with a primary or secondary diagnosis with an International Classification of Diseases, Ninth Revision (ICD-9), code for cervical cancer (180.0–180.9); 2) have been continuously enrolled for 6 months before and after the index diagnosis date, which was the first date when a cervical cancer diagnosis code appeared during the study period; and 3) be aged 18 years or older. We excluded cases with 1-year costs greater than $1 million U.S. dollars.

The control group was selected from the Texas female population without a claims-based ICD-9 code for HPV-related cancer or cancer at any site (140.0–208.9) and aged 18 or older. Two steps were used in the control selection process. In the first step, an initial group of population controls was selected on the basis of 4 matching criteria with respect to cancer cases: 1) index date identical to the index date of the case (index dates for cases were randomly assigned to all non-cases); 2) no cancer ICD-9 code during the 6 months prior to the index date, and 6 months of continuous enrollment before and after the index date; 3) age $\pm$ 5 years; and 4) insurance type (commercial vs. Medicare only). From this initial group, a single population control was then selected for each cancer case using nearest-available-Mahalanobis-metric matching within calipers defined by the propensity score [11,12]. The propensity score was produced from the following 5 covariates: 1) Charlson Comorbidity Index score during 6 months period before the index date (the Charlson Comorbidity Index was modified such that any malignancy, metastatic solid tumor, or chronic pulmonary disease were excluded) [13,14]; 2) count of the number of Psychiatric Diagnosis Groups during 6 months period before the index date [15]; 3) healthcare costs observed between 6 months and 3 months prior to the index date (costs incurred during the 3 months immediately prior to the index date were excluded because these costs were more likely to be associated with the cancer diagnostics and could cause biased estimates) [16]; 4) health plan type [basic/major medical; comprehensive; exclusive provider organization (EPO)/missing; health maintenance organization/point-of-service plan (POS) with capitation/POS; preferred provider organization (PPO); or consumer-directed health plan/high-deductible health plan (CDHP/HDHP)]; and 5) Texas region, based on 3-digit zip code area [northeast (750–752, 754–762, 764, and 766–767), southeast (765, 770, 773–787, and 789), and west (remaining zip codes)]. These regions include Dallas-Ft. Worth (northeast), Houston, Austin, Corpus Christi, and San Antonio (southeast/central), and El Paso, Midland-Odessa, and Lubbock (west) and surrounding populations. These regions represent major geographic and cultural areas in Texas.

2.3. Economic outcome measures and statistical analysis

Cost was measured as the total gross payment to a provider for a specific service (i.e., the amount eligible for payment after application of pricing guidelines, such as fee schedules and discounts, and before application of deductibles, copayments, and coordination of benefits). Overall, inpatient, outpatient, and pharmacy costs incurred during the 2 years after the index date were calculated and compared between case and control groups. Monthly costs in the first 2 years after the index date were also calculated. All costs were healthcare inflation adjusted to 2015 U.S. dollars using the medical care component of the United States Bureau of Labor Statistics Consumer Price Index [17]. For cases and controls with <2 years of follow-up, a generalized linear model was employed to compute the costs for censored months using the log-link function for the cost variable [18]. Independent variables included in the model to predict the cost were age, Charlson Comorbidity Index score, number of Psychiatric Diagnosis Groups, health plan type, Texas region, case-control group indicator, costs incurred between 6 months and 3 months before prior to the index date, censor indicator, and a polynomial of months since the index date. Generalized polynomial regression was used for describing the non-linear relationship between month and cost. The model with the lowest Akaike information criterion value was chosen as the best fitted model to determine the degree of the polynomial [19].

Baseline characteristics for cases and controls were reported using numbers and percentages for categorical variables and means and standard deviations for continuous variables. The comparability of baseline characteristics between cases and controls was assessed using chi-square tests for categorical variables and *t*-tests for continuous variables.

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