Determinants of Hospital Length of Stay for Cervical Dysplasia and Cervical Cancer: Does Managed Care Matter?

···

Gregory D. Berg, PhD; and Sajal K. Chattopadhyay, PhD

Objective: To examine whether type of health insurance plan, among other variables, affects the length of stay for cervical cancer-related hospitalizations.

Study Design, Patients, and Methods: Inpatient admission claims records for cervical dysplasia and cervical cancer were selected for 1994-1997 from the MarketScan private health insurance claims database. After identifying records by stage of disease and deleting records for pregnant women, 1145 unique patient records were used in a truncated count regression model to analyze the predictors of hospital length of stay.

Results: All later stages of disease were associated with a longer hospital stay. After controlling for other variables, the coefficients showed an increase in predicted length of admission ranging from 2.5 days for stage I to 6.3 days for stage IV cervical cancer compared with dysplasia/carcinoma in situ (all stages, *P* < .01). There was no significant statistical difference in the lengths of stay for patients covered under comprehensive fee-for-service plans vs other types of health insurance plans, including managed care.

Conclusions: Managed care plans are often thought to contain healthcare costs by shortening the hospital length of stay. Our findings show no association between managed care plans and hospital length of stay for women with cervical cancer or its precursors.

(Am J Manag Care. 2004;10:33-38)

M anaged care plans have dominated recent market efforts to contain healthcare cost inflation. However, their cost-cutting strategies aimed at restricting the volume and mix of services and limiting hospital length of stay (LOS) have been the focus of much criticism. The LOS for programs such as substance abuse treatment is often regarded as a standard measure of treatment success.[1] Studies of extremely short hospital stays for childbirth, on the other hand, have highlighted the health risks to mothers and newborns, prompting many states to adopt "early discharge" legislation or other regulations mandating insurers to cover minimum postpartum hospital stays.[2-5] Several other studies have looked at the effect of managed care on LOS without addressing at the same time the issue of quality or clinical health outcomes; these studies have covered spinal cord injury[6] and stroke[7] as well as psychiatric and mental health services.[8-10]

In this study, we analyze the predictors of LOS for cervical cancer-related hospitalizations. In particular, we examine whether there are differences across payer groups in LOS related to cervical dysplasia and cervical cancer. The American Cancer Society[11] estimated that 12 200 new cases of invasive cervical cancer would be diagnosed in the United States in 2003 and that 4100 women would die of the disease. In addition, 50 000 to 60 000 new cases of carcinoma in situ (CIS) were expected. Without early detection and treatment, many of these lesions may eventually progress to invasive cervical cancer.

No uniform standard of care has emerged for cervical cancer mostly because of the complexity of the disease. Treatment modalities for cervical cancer differ fundamentally from those for pre-invasive lesions, and the hospital LOS depends on the stage of the disease and the comorbidities of the patient. Although previous studies[12-14] have examined the association between hospital utilization and types of health insurance plans in general, the issue of how different insurance plans impact resource utilization specifically for treatment of cervical cancer and its precursors has received little attention so far.

For this analysis, we combined 1994-1997 data from a large private insurance database. To model LOS, we

From the Division of Cancer Prevention and Control, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, Ga. Dr Berg is now with McKesson Corporation, Broomfield, Colo. Dr Chattopadhyay is now with the Division of Prevention Research and Analytic Methods, Epidemiology Program Office, Centers for Disease Control and Prevention.

This study was presented in part at the Third International Health Economics Association Meetings, York, England, July 23, 2001.

Corresponding author: Sajal K. Chattopadhyay, PhD, Division of Prevention Research and Analytic Methods, Epidemiology Program Office, Centers for Disease Control and Prevention, Mail stop K-73, 4770 Buford Highway, NE, Atlanta, GA 30341. E-mail: skc9@cdc.gov.

estimated a negative binomial (NB) count data regression, which, unlike Poisson count data models, allows the mean and the variance to be different.

....

DATA AND METHODS

Data Source

Data used in this study were obtained from MedStat's MarketScan[15] database, the largest multisource healthcare database in the United States for the private sector. The database comes from a variety of private insurance benefit plans and consists of claims and encounter records from more than 100 large employers. It covers employees, early retirees, COBRA (Consolidated Omnibus Budget Reconciliation Act) continuees, and dependents—approximately 3.5 million persons annually. Reflecting the participating firms, the population represented is younger, has a higher income, and is more likely to be employed than is the general US population. This data set is particularly useful for our study as cervical cancer affects many younger women, and, based on cancer cases diagnosed during 1997-1999, the probability of developing invasive cancer was found to be higher in the 40- to 59-year-old group than in the 60- to 79-year-old group.[11] This is in contrast with most other cancers, including breast cancer, where risk of the disease increases systematically with age.

Methods

Hospital inpatient admission claims records were selected if the principal diagnosis had an *International Classification of Diseases, Ninth Revision,* code of 180.0, 180.1, 180.8, 180.9, 233.1, or 622.1. These codes correspond to malignant neoplasm of the endocervix, exocervix, other specified sites of the cervix, cervix/uteri unspecified, CIS cervix/uteri, and dysplasia of the cervix, respectively.

Pregnant women were excluded from the LOS analysis, as it was difficult to isolate the effects of cervical cancer and its precursors from the effects of pregnancy. The deletion criterion for pregnant women was the presence of *International Classification of Diseases, Ninth Revision,* code V220-V221, V230-V239, V270-V278, or V300-V392 for any of the diagnosis categories. Observations lost by eliminating pregnancy-related claims accounted for less than 0.3% of inpatient claims records.

The MarketScan data contain information on 7 different types of health plans. The basic/major medical and the comprehensive plans are the traditional fee-for-service plans that reimburse medical expenses regardless of who provides the services. The premiums for the comprehensive plans are higher because they offer better protection. The other 5 plans are variants of managed care. In the exclusive provider organization, the insured is restricted to selecting providers from a limited list and may be required to pay for the entire cost of care obtained outside of this network. In HMOs, comprehensive health services are provided to members in exchange for a fixed, prepaid fee. Most HMOs require the insured to go to a healthcare provider within their organization, and a primary care provider usually directs services and referrals. The preferred provider organization is a group of physicians, hospitals, and other healthcare providers (preferred providers) that have agreed to provide services to members of a health plan for discounted fees. Point-of-service health plans with or without capitation combine the features of an HMO with an indemnity insurance option. The member uses the plan like an HMO and receives HMO coverage; however, the member has "freedom of choice" and may seek care outside the HMO system with higher copayments and deductibles. We first looked at the cross-tabulation of LOS by plan type and applied the nonparametric Kruskal-Wallis[16] test to examine whether LOS differs across plan types. We then used the truncated NB regression model to adjust for possible confounders in any association between LOS and benefit plan type.

The predictor variables used in the regression analysis of LOS included disease category, patient age, total number of procedures listed for an admission, type of benefit plan, geographic region, admission type, hysterectomy, and a time trend. Patient age and geographic region were included as predictor variables in previous studies of hospital LOS.[17,18]

For disease classification based on primary and secondary diagnoses, we followed the method described in **Table 1.**[19] Categories of disease included cervical dysplasia, CIS, and cervical cancer (stages I through IV). For this analysis, however, we combined dysplasia and CIS into a single group because CIS corresponds to cervical intraepithelial neoplasia III or severe dysplasia. Also, we merged stages II and III because there were few stage III cancers and because given the definitions in Table 1, stage III is actually a subset of stage II. After identifying claims records by stage and deleting records for pregnant women, 1145 unique inpatient records remained for the regression analysis of LOS.

Examination of the principal procedure code for all 1145 inpatient admissions revealed 126 different procedures. Five of these procedures accounted for 63% of the records: total abdominal hysterectomy (corpus and cervix) with or without removal of tube(s) or ovary(s), vaginal hysterectomy, laparoscopic-assisted vaginal

Table 1. Cervical Cancer and Its Precursors: Disease Classification Criteria[19]

Stage	Primary *ICD-9* Codes	Secondary *ICD-9* Codes
Dysplasia	622.1	No diagnosis indicating cancer or carcinoma in situ (140-239.9 or 230-234.9)
Carcinoma in situ	233.1	No diagnosis indicating cancer (140-239.9)
Stage I	180.0, 180.1, 180.8, and 180.9	No diagnosis indicating other forms of cancer
Stage II	180.0, 180.1, 180.8, and 180.9	198.82, 198.6, 179, 181, 182.x, 183.x, and 184.x
Stage III	180.0, 180.1, 180.8, and 180.9	198.82, 198.6, 179, 181, 182.x, 183.x, and 184.x and either of these codes 593.5, 599.6, 593.89, and 591
Stage IV	180.0, 180.1, 180.8, and 180.9	199.1, 199.0, 140.x-176.x, 188.x-195.x, 179.x, 198.0, 198.1, 198.2, 198.3, 198.4, 198.5, 198.7, 198.81, and 198.89

ICD-9 indicates *International Classification of Diseases, Ninth Revision.*
Adapted from reference 19.

hysterectomy, radical abdominal hysterectomy with bilateral pelvic lymphadenectomy and para-aortic lymph node sampling (biopsy) with or without removal of tube(s) or ovary(s), and vaginal hysterectomy with removal of tube(s) or ovary(s). This finding explains our use of hysterectomy as a predictor variable for hospital LOS. The sum of all procedures was listed as a predictor variable to account for the severity of case mix.

The LOS (in days) was used as the count-dependent variable in the regression. The more common linear regression model is not appropriate here because the dependent variable can only take a finite set of values. Poisson models are often used to model these types of data, but Poisson models require the mean and the variance of the dependent variable to be equal. An alternative is to use an NB specification, which includes the Poisson as a special case.[20,21] As such, a test of the Poisson model can be imposed in the NB model. The NB differs from the Poisson in that it does not require the mean and the variance to be equal, and it allows the data to be overdispersed (ie, the variance is larger than the mean).

We use the terminology for the NB model as presented by Grogger and Carson (1991).[20] The NB models allow the mean and the variance to be different depending on an α parameter. It is a generalization of the Poisson distribution and equal to the Poisson if α is equal to zero (more precisely as $\alpha \rightarrow 0$). A test of the NB, which allows for overdispersion, vs the Poisson, which requires a mean:variance equality, is testing H_0: $\alpha = 0$ against the alternative H_1: $\alpha > 0$. We used the truncated NB model because our data selection process precludes the possibility of zero values for LOS.[22]

RESULTS

The descriptive statistics of LOS by health plan type are given in **Table 2.** There are no zero LOS cases. We ran the NPAR1WAY procedure in SAS to examine Wilcoxon scores for hospital days classified by plan type. The Kruskal-Wallis test showed that the LOS differences among the plan types had a $P = .058$. This suggested that there might be differences at least at the 10% level when other variables were not controlled for in a regression model.

Table 2. Descriptive Statistics of Length of Stay by Plan Type

Plan Type	Observations, No. (n = 1145)	Length of Stay, Mean (Range), Days
Basic	67	3.81 (1-30)
Comprehensive	458	3.51 (1-52)
Exclusive provider organization	6	3 (1-6)
HMO	46	3.37 (1-24)
Point of service	96	4.78 (1-64)
Preferred provider organization	387	3.26 (1-55)
Point of service with capitation	85	6.07 (1-91)

Table 3. Summary of Descriptive Statistics

	Inpatient Claims (n = 1145)
Hospital length of stay in days, mean (SD)	3.7 (6.4)
Procedures listed, mean (SD), No.	3.1 (3.2)
Age, No. (%)	
≤45 y	707 (61.7)
46-55 y	255 (22.3)
56-65 y	171 (14.9)
>65 y	12 (1.1)
Disease category, No. (%)	
Dysplasia/carcinoma in situ	778 (68.0)
Stage I	179 (15.6)
Stage II/III	112 (9.8)
Stage IV	76 (6.6)
Region of residence, No. (%)	
Northeast	97 (8.5)
North central	306 (26.7)
South	570 (49.8)
West	108 (9.4)
Unknown	64 (5.6)
Admission type, No. (%)	
Surgical	943 (82.4)
Medical	202 (17.6)
Hysterectomy, No. (%)	
Yes	724 (63.2)
No	421 (36.8)
Year, No. (%)	
1994	153 (13.4)
1995	300 (26.2)
1996	322 (28.1)
1997	370 (32.3)

The descriptive statistics for the explanatory variables used in the LOS regression analysis are given in **Table 3.** Means and SDs are provided for the continuous variables. For categorical variables, actual counts of observations and their percentages are supplied. Dysplasia and CIS accounted for most inpatient admissions. Admissions were predominantly for surgical reasons, with comprehensive fee-for-service and preferred provider organization plans being the predominant forms of insurance coverage. Regionally, the total number of admissions was highest in the south. The number of admissions showed a continuous increase over the years and was the highest in 1997.

The results of the truncated NB regression are shown in **Table 4.** The hypothesis H_0: $\alpha = 0$ tested against the alternative H_1: $\alpha > 0$ was rejected in favor of the alternative at the 1% level, indicating that the Poisson model was rejected in favor of the NB and overdispersion.

The disease classification variables were all significant. The coefficients showed an increase in predicted length of admission ranging from 2.5 days for stage I to 6.3 days for stage IV cervical cancer vs dysplasia/CIS (all stages, $P < .01$) after controlling for all other variables. The coefficient for the number of procedures performed during the admission was positive and significant ($P < .01$). Medical admission resulted in an additional positive impact on LOS compared with surgical admission ($P < .05$). Hysterectomy was positively, but not significantly, associated with LOS. To account for possible multicollinearity between hysterectomy and admission type, we ran the regression without including admission type as a predictor variable. However, this did not result in a statistically significant coefficient for the hysterectomy variable. The negative value for the time trend coefficient indicated a decline in LOS over time, but the trend was not statistically significant.

All other variables were not significant at the 5% level or greater, including 6 benefit plan type variables vs comprehensive fee-for-service plans. For exclusive provider organization plans, the statistical insignificance may partly be attributed to the small number of observations in this category. Deleting this variable did not affect the sign and statistical significance of the other variables and produced very small changes in the magnitudes of some coefficients while leaving the magnitudes of the other coefficients unchanged. In general, our findings indicate that most other types of insurance coverage do not significantly affect LOS for cervical cancer or its precursors when comprehensive fee for service is the comparison group.

CONCLUSIONS

This study investigated the determinants of LOS for hospitalizations related to cervical cancer. The finding that most admissions were caused by dysplasia and CIS may seem counterintuitive, but this result can be explained by the nature of treatment for cervical cancer or its precursors. Most of the admissions for women with dysplasia or CIS were for hysterectomy, an accepted treatment in women who have finished bearing children. National Hospital Discharge Survey data from 1988 to 1997 suggested that most hysterectomies in the United States were performed for benign conditions (83.1%).[23] We could not obtain information about parity status and other variables for women who could provide a better explanation about the preponderance of hysterectomy for dysplasia/CIS cases. Our regression results, however, show that although hysterectomy may be responsible for initial hospital

admission, it did not have any incremental effect on hospital LOS beyond the other principal procedures listed for these admissions. Regarding invasive cervical cancer, radiotherapy and other treatment methods may routinely be provided on an outpatient basis that would have escaped our inquiry.

Later stages of the disease and the number of procedures performed would be expected to relate to severity of the case, and we found that both were associated with a longer LOS. We did not find that HMOs, point-of-service with capitation plans, or other benefit plans materially affect LOS when comprehensive fee-for-service plans are used as the referent. The cost efficiency of some managed care plans for cervical cancer-related hospitalizations thus should be attributable to other factors, such as utilization review, patients with less comorbidities, and lower reimbursement rates per admission.

Both the principal finding and the method are interesting outcomes of this study. The method is interesting because we used a count data model. It is possible to analyze LOS using multiple linear regression, but the preponderance of small values and the integer nature of LOS suggest that improvements to linear regression can be made. One alternative is the Poisson regression model, which accounts for characteristics of integer-dependent variables (such as LOS) and has been widely used to study such data. A further improvement is the NB specification, which is a flexible alternative to the Poisson. As a testable special case, the NB reduces to the Poisson. This test shows that Poisson distribution is not appropriate given our data.

The implication of the main finding is best illustrated by a counterargument. If managed care plans are found to have shorter LOSs than more generous plans, one could question the appropriateness of the reduced LOS. The quality of medical service in a managed care setting may be held in doubt, as early discharge could result in complications adversely affecting health outcomes. Given that managed care organizations typically have lower costs than more generous plans, our finding of no difference in LOS, even after adjusting for other factors, suggests that managed care plans may improve the efficiency

in hospital resource use, at least for the case of cervical cancer and its precursors. However, detailed measures of cost and quality of hospital care must be obtained and considered for proper evaluation of the relative efficiency of different health plans.

Table 4. Regression Results of Number of Days Admitted for Cervical Cancer or Its Precursors

Parameter	Estimate	P
ALPHA	0.65	< .01
PROC_NUM	0.17	< .01
Age group		
≤45 y	Baseline	Baseline
46-55 y	0.13	.44
56-65 y	0.44	.10
>65 y	1.64	.25
Disease stage		
Dysplasia/carcinoma in situ	Baseline	Baseline
Stage I	2.54	< .01
Stage II/III	2.85	< .01
Stage IV	6.31	< .01
Benefit plan		
Comprehensive	Baseline	Baseline
Basic	0.06	.85
Exclusive provider organization	0.21	.81
HMO	0.06	.86
Point of service	0.40	.16
Preferred provider organization	0.19	.22
Point-of-service with capitation	0.31	.36
Region		
South	Baseline	Baseline
Northeast	−0.03	.92
North central	0.11	.50
West	−0.29	.16
Unknown	−0.10	.72
Admission type		
Surgical	Baseline	Baseline
Medical	0.73	.04
Hysterectomy		
No	Baseline	Baseline
Yes	0.16	.43
Year		
Time trend	−0.02	.70
Constant	0.92	< .01

....
REFERENCES

1. **Shwartz M, Mulvey K, Woods D, Brannigan P, Plough A.** Length of stay as an outcome in an era of managed care: an empirical study. *J Subst Abuse Treat.* 1997;14:11-18.

2. **Declercq E, Simmes D.** The politics of "drive-through deliveries": putting early postpartum discharge on the legislative agenda. *Milbank Q.* 1997;75:175-202.

3. **Tai-Seale M, Rodwin M, Wedig G.** Drive-through delivery: where are the "savings"? *Med Care Res Rev.* 1999;56:30-46.

4. **Ulmer RH.** Drive-through deliveries, patient rights and physician autonomy. *Wis Med J.* 1996;95:751-752.

5. **Wall EM.** When medicine and politics collide: early newborn discharge. *J Am Board Fam Pract.* 1996;9:298-300.

6. **Fiedler I, Laud P, Maiman D, Apple D.** Economics of managed care in spinal cord injury. *Arch Phys Med Rehabil.* 1999;80: 1441-1449.

7. **Monane M, Kanter D, Glynn R, Avorn J.** Variability in length of hospitalization for stroke: the role of managed care in an elderly population. *Arch Neurol.* 1996;53:875-880.

8. **Wickizer T, Lessler D, Travis K.** Controlling inpatient psychiatric utilization through managed care. *Am J Psychiatry.* 1996;153:339-345.

9. **Criscione T, Kastner T, Walsh K, Nathanson R.** Managed health care services for people with mental retardation: impact on inpatient utilization. *Ment Retard.* 1993;31:297-306.

10. **Gold J, Shera D, Clarkson B Jr.** Private psychiatric hospitalization of children: predictors of length of stay. *J Am Acad Child Adolesc Psychiatry.* 1993;32:135-143.

11. **American Cancer Society.** *Cancer Facts and Figures 2003.* Atlanta, Ga: American Cancer Society; 2003.

12. **Miller R, Luft H.** HMO plan performance update: an analysis of the literature, 1997-2001. *Health Aff (Millwood).* 2002;21:63-86.

13. **Anderson G, Zhang N, Worzala C.** Hospital expenditures and utilization: the impact of HMOs. *Am J Manag Care.* 1999;5:939-941.

14. **Stern R, Juhn P, Gertler P, Epstein A.** A comparison of length of stay and costs for health maintenance organization and fee-for-service patients. *Arch Intern Med.* 1989;149:1185-1188.

15. **MedStat.** *MarketScan Database.* Ann Arbor, Mich: The MedStat Group Inc; 1999.

16. **Kruskal W, Wallis W.** Use of ranks in one-criterion variance analysis. *J Am Stat Assoc.* 1952;47:583-621.

17. **Brooks S, Chen T, Ghosh A, Mullins C, Gardner J, Baquet C.** Cervical cancer outcomes analysis: impact of age, race, and comorbid illness on hospitalizations for invasive carcinoma of the cervix. *Gynecol Oncol.* 2000;79:107-115.

18. **Chassin MR.** *Health Technology Case Study 24: Variations in Hospital Length of Stay: Their Relationship to Health Outcomes.* Washington, DC: Office of Technology Assessment; August 1983. OTA-HCS-23.

19. **Agency for Health Care Policy and Research.** *Evidence Report: Evaluation of Cervical Cytology.* Rockville, Md: Agency for Health Care Policy and Research; 1999. AHCPR Publication No. 99-E010.

20. **Grogger J, Carson R.** Models for truncated counts. *J Appl Econometrics.* 1991;6:225-238.

21. **Gurmu S, Trivedi P.** Overdispersion tests for truncated Poisson regression models. *J Econometrics.* 1992;54:347-370.

22. **Cameron A, Trivedi P.** Econometric models based on count data: comparisons and application of some estimators and tests. *J Appl Econometrics.* 1986;1:29-53.

23. **Saraiya M, Lee N, Blackman D, Smith M-J, Morrow B, McKenna M.** Self-reported Papanicolaou smears and hysterectomies among women in the United States. *Obstet Gynecol.* 2001;98: 269-278.