

Hospitalization for Nontraumatic Disorders of the Eye and Ocular Adnexa

Analysis of the Florida Agency for Health Care Administration Data Set

Zuber D. Mulla, MSPH, PhD; Curtis E. Margo, MD, MPH

Objective: To study the demographic features and patterns of hospital admission in Florida for nontraumatic disorders of the eye and ocular adnexa.

Methods: The public data set from the Florida Agency for Health Care Administration for 2001 was used to identify persons hospitalized for 24 hours or longer for nontraumatic disorders of the eye and ocular adnexa by using *International Classification of Diseases, Ninth Revision, Clinical Modification* codes.

Results: In 2001, there were 2137 hospital admissions for nontraumatic disorders of the eye and ocular adnexa, most of which were for infections or neuro-ophthalmologic disorders. The median length of stay was 3.0 days (mean±SD, 3.4±3.8 days). On average, 1 patient was admitted per month to 180 Florida hospitals.

Eighty-three patients (3.9% of eye admissions) were hospitalized for 10 days or longer and accounted for 18.1% of total hospital-patient days. Prolonged hospital stay was positively associated with hospital transfer ($P < .001$) and facial cellulitis ($P = .04$). A trend for positive association with Medicaid coverage was also observed ($P = .07$).

Conclusions: Nontraumatic eye care composes a small proportion of all inpatient care ($< 0.1\%$) in Florida. Few of these patients require prolonged hospitalization but use a large proportion of inpatient care on the basis of the percentage of gross charges. An opportunity exists to improve hospital efficiency and improve eye care by targeting the patients at highest risk for prolonged hospital stay.

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MODERN HOSPITALS ARE important collective investments of communities and the place most people think of going when they are seriously ill or injured. Hospitals are typically the caregivers of last resort for persons without medical insurance and the hub of medical education. During the past decade, hospitals have come under intense financial and legislative pressure to reduce waste, cut costs, and improve efficiency. The effects of these forces on hospitals are complex and often difficult to selectively measure. Data from the Agency for Healthcare Research and Quality, for instance, have shown declining hospital stays but rising hospital charges throughout the United States from 1993 through 2000.¹

Despite the central role hospitals have in our health care system, there is little population-based information on inpatient eye care. Previous studies of hospital eye care have dealt with ocular injury.²⁻⁵ To better understand the nature, distribution, and volume of inpatient eye

care not related to trauma, we studied the hospital discharge data set of the Florida Agency for Health Care Administration (AHCA), Tallahassee, Fla, for 2001.

METHODS

The public-use hospital discharge data set from AHCA for Florida for 2001 was accessed for clinical and demographic information for patients discharged with primary diagnoses for eye and ocular disease by using the *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)*. This comprehensive set of codes included benign and malignant neoplastic diagnoses of the eye, conjunctiva, eyelids, lacrimal gland, ocular adnexa, and orbit (**Table 1**).

The 2001 AHCA data set includes discharge summaries from all nonfederal Florida hospitals except state tuberculosis hospitals and state mental health hospitals. After data are entered into the system, they are subjected to formatting and logic checks. The primary hospital submitting patient information must then certify the data are correct and also verify the accuracy of a summary report before it is released by the AHCA.

From the Discipline of Epidemiology, School of Public Health, El Paso Regional Campus, University of Texas Health Science Center at Houston (Dr Mulla); and the Department of Ophthalmology, Watson Clinic, Lakeland, Fla (Dr Margo). The authors have no relevant financial interest in this article.

We retrieved patient information (age, race, and sex), primary admission diagnosis, principle procedure code, principal payer, day of week of admission, total gross charges for hospitalization, hospital, length of stay, days before procedure, source of admission (physician referral, clinic referral, health maintenance organization referral, hospital transfer, emergency room, court or law enforcement, nursing home, other health care facility transfer, and other), and discharge status (1 of 9 levels). Admission type was classified by the admitting physician as emergency, urgent, or elective; when applicable, admission type was classified by the coding technician as newborn or other. Management systems for medical insurance, such as health maintenance organization or preferred provider organization, were reported according to the primary insurance carrier (eg, Medicare, Medicaid, commercial, government, workers' compensation, CHAMPUS, etc).

For the purpose of this study, diagnostically related ICD-9-CM codes were combined to simplify analysis and minimize potential coding variations due to semantic differences in making clinical diagnoses. For example, endophthalmitis included 3 ICD-9-CM codes: 36000 endophthalmitis, 36001 acute endophthalmitis, and 36002 panophthalmitis.

Annual rates of admission were calculated by using 2000 US census data extrapolated to the study year and were expressed as number of hospital admissions per 100 000 population.

The SAS System release 8.01 for Windows (SAS Institute Inc, Cary, NC) was used to analyze the data. Frequencies were reported as percentages. Prolonged length of stay was defined as hospitalization for 10 days or more. Frequency distributions were examined before and after stratification according to length of stay. Crude and adjusted odds ratios were calculated by using logistic regression.⁶ The adjusted odds ratios were derived from 1 full model that contained the following variables: age, male sex, black race (as compared with white), Medicaid enrollees (as compared with self-pay, commercial insurance, or other), emergency or urgent admission (as compared with elective admission), and source of admission (hospital transfer, as compared with other sources). We did not detect collinearity among these independent variables.

After deleting records that had missing values for the dependent variable and/or independent variables, records of patients who were not black or white, and records of patients who were discharged to another hospital, 1698 records were available for logistic regression. The records of patients who were discharged to another hospital (n=45) were deleted to minimize the probability of including multiple records for a single patient in the multivariate analysis. The χ^2 test was used to compare patients deleted from the regression analysis because of an incomplete data field, according to frequency of primary admission diagnosis, with those who remained in the analysis. An odds ratio greater than 1.00 indicated that the variable increased the odds of prolonged length of stay, while an odds ratio less than 1.00 indicated that the variable protected against it. Ninety-five percent confidence intervals were calculated in the traditional manner. Results were considered significant ($P \leq .05$) if the confidence interval excluded the null value of 1.00.

The potential role of secondary diagnoses in hospital length of stay was assessed by examining the frequency distribution of these diagnoses according to length of stay. Differences between the 2 groups were tested for statistical significance by using the Fisher exact test.

RESULTS

From January 1, 2001, through December 31, 2001, 268 Florida hospitals had 2 343 138 admissions with a hospi-

Table 1. Hospital Admissions Identified With ICD-9-CM Diagnostic Codes*

Code	Description
172	Melanoma, eyelid
173	Malignancies, other, eyelid
360	Disorders of the globe
361	Retinal detachments and defects
362	Other retinal disorders
363	Chorioretinal inflammation and other disorders of choroid
364	Disorders of iris and ciliary body
365	Glaucoma
366	Cataract
367	Disorders of refraction and accommodation
368	Visual disturbances
369	Blindness and low vision
370	Keratitis
371	Corneal opacity and other disorder of cornea
372	Disorders of conjunctiva
373	Inflammation of eyelids
374	Other disorders of eyelids
375	Disorders of lacrimal system
376	Disorders of the orbit
377	Disorders of optic nerve and visual pathways
378	Strabismus and related disorders of motility
190	Malignant neoplasms
173.1	Malignant neoplasms, eyelid
224	Benign neoplasms
216.1	Benign neoplasms, eyelid

Abbreviation: ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification.

*Excludes admissions for ocular trauma identified with specific ICD-9-CM codes.⁵

tal stay of 24 hours or more. Of these admissions, 2858 were for primary disorders of the eye and ocular adnexa. Seven hundred twenty-one admissions (0.03%) for injuries to the eye and ocular adnexa were excluded and are the data set of a separate study. The remaining 2137 (0.09%) admissions to 180 hospitals for nontraumatic disorders of the eye and ocular adnexa composed the data set of this study.

More than 95% of patients (n=2034) listed a primary residence ZIP code in Florida; 29 (1.4%) resided outside the country. The median number of patients admitted per hospital was 6 (mean \pm SD, 11.9 \pm 17.2).

The nontrauma admissions involved 1011 male patients (47.3%) and 1126 female patients (52.7%) and were listed with 204 different ICD-9-CM codes. One thousand three admissions (46.9%) were classified as emergency, 624 as urgent (29.2%), and 510 as elective (23.9%). Nearly 48% of the admissions were through hospital emergency departments, and 41% were direct admissions by staff physicians. There were 56 hospital transfers (2.6%). The mean \pm SD age at admission was 46.5 \pm 29.2 years. One thousand four hundred two patients were white (65.6%), 336 were black (15.7%), and 332 were Hispanic (including both black and white Hispanic; 15.5%) (**Table 2**). The most patients were admitted on Tuesday (17.6%) and the least on Sunday (9.1%).

The median length of hospital stay was 3.0 days (mean \pm SD, 3.4 \pm 3.8 days; range, 1-92 days). Five hundred fifty-seven patients (26.1%) were discharged after 1 day, 495 (23.2%) after 2 days, and 381 (17.8%) after 3 days. Eight-three patients (3.9%) remained hospitalized

Table 2. Hospital Admissions for Nontraumatic Disorders of the Eye Stratified by Length of Stay

Description	Overall	9 Days or Fewer	10 Days or More
No. of patient admissions	2137	2054	83
Rate of admission per 100 000, %*	13.0	12.5	0.5
Sex, No. (%)			
Male	1011 (47.3)	967 (47.1)	44 (53.0)
Female	1126 (52.7)	1087 (52.9)	39 (47.0)
Race or ethnicity, No. (%)			
White	1402 (65.6)	1347 (65.6)	55 (66.3)
Black	336 (15.7)	318 (15.5)	18 (21.7)
Hispanic†	332 (15.5)	323 (15.7)	9 (10.8)
Race of admission per 100 000, %*			
White	10.9	10.5	0.4
Black	14.7	13.9	0.8
Hispanic†	12.1	11.7	0.3
Age, y			
Median	52.0	52.0	49.0
Mean	46.5	46.5	45.8
SD	29.2	29.2	29.5
Gross hospital charges, \$			
Median	8665	8357	26 418
Mean	11 307	10 158	39 744
SD	12 345	7540	41 165
Insurance coverage, No. (%)‡			
Medicare	751 (35.1)	728 (35.4)	25 (30.1)
Medicaid	326 (15.3)	304 (14.8)	22 (26.5)
Commercial	487 (22.8)	470 (22.9)	17 (20.5)
Uninsured§	190 (8.9)	183 (10.9)	7 (8.4)

*Annual rate per 100 000 population.

†Includes white and black Hispanic.

‡Reports members of health maintenance organizations and preferred provider organizations in the category of Medicare, Medicaid, or commercial according to their single major carrier.

§Includes discharge categories of self-pay, charity, and other.

Table 3. Comparison of Average Daily Charges of Hospitalization*

Primary Admission or Discharge Diagnosis	Average Daily Charge, \$
Disorders of the eye and/or ocular adnexa	3325
Septicemia	3050
Cardiac dysrhythmia	4062
Stroke	3064
Pneumonia	2590
Congestive heart failure	2809
Nonspecific chest pain	4313
Chronic obstructive lung disease	2425

*Cost of nonocular admissions are from the Agency of Health Research and Quality.¹ The 2001 charges in Florida for inpatient eye care are compared with inflation-adjusted national averages for other types of hospital care.

between 10 and 92 days. The total number of days spent hospitalized for eye care was 7256 (ie, hospital-patient days). Eighty-two percent of all eye patients were discharged home, 3.0% to a skilled nursing home, and 4.3% to home care with supervision of a health care organization. Because there were no hospital deaths, the terms “discharge” and “admission” are used interchangeably.

The median gross charge for hospital admission, not including professional fees, was \$8665 (mean ± SD,

\$11 307 ± \$12 345) (Table 2). The median gross charge for patients hospitalized 9 days or fewer was \$8357 (mean ± SD, \$10 158 ± \$7540) and for 10 days or more was \$26 418 (mean ± SD, \$39 744 ± \$41 165) (Table 2). The most frequent payer sources were Medicare (35.1%), commercial insurance (22.8%), and Medicaid (15.3%) (Table 2). The total number of uninsured patients was estimated by combining the 3 payer categories: charity, other, and self-pay. With this definition, 190 patients (8.9%) lacked insurance coverage at the time of discharge. The mean charge for hospitalized eye care in Florida was \$3325 per day, which is comparable with other types of inpatient care on the basis of national averages (Table 3).

The 2 most common reasons for nontrauma admission (ie, principal diagnoses) were acute inflammation (cellulitis) of the orbit (19.9%) and diplopia and/or cranial nerve palsies (11.1%) (Table 4). The 10 most frequent diagnostic categories accounted for approximately 75% of all admissions (Table 4). Overall, these hospitalizations were not procedure intense; no single procedure was performed in more than 50 patients (ie, in fewer than 2.3% of all hospitalized eye patients). The 7 most frequent hospital procedures were as follows: removal of surgical implant in 49 patients, destruction of retinobulbar lesion in 47 patients, scleral buckling procedure in 47 patients, mechanical vitrectomy in 40 patients, orbital surgery in 39 patients, artery biopsy in 29 patients, and cerebral angiography in 29 patients.

The 83 patients (3.9%) who were hospitalized for 10 days or longer accounted for 1310 hospital-patient days, or 18.1% of the total days of inpatient care. Their gross cost for hospitalization was \$3 298 752, or 13.7% of the total eye care–related charge of \$24 160 922. Prolonged hospitalization was significantly associated with hospital transfer (adjusted odds ratio, 7.38; 95% CI, 3.18–17.13) (Table 5). There was a positive trend for prolonged stay with Medicaid coverage (adjusted odds ratio, 1.93; 95% CI, 0.95–3.95). No associations were found with age, race, or type of admission (Table 5). There were only minor differences in the distribution of diagnoses for patients with prolonged stay, except for a 3-fold increase in keratitis. The most frequent diagnoses for prolonged stay were acute orbital inflammation (21 patients [25.3%]) and keratitis and/or ulcer (15 patients [18.1%]).

There were 624 unique secondary admission diagnoses. The 3 most common were systemic hypertension (7.6%), atrial fibrillation (3.3%), and chronic lung disease (2.4%). When the proportion of the 12 most common secondary diagnoses were examined according to length of stay, only 2 showed a statistically significant difference between groups: patients with systemic hypertension were more likely to be discharged within 9 days ($P = .004$), while those with facial cellulitis were more likely to have a prolonged hospitalization ($P = .04$).

COMMENT

The Florida AHCA database revealed that there were 2137 hospital admissions for nontraumatic disorders of the eye and ocular adnexa in 2001, or fewer than 0.1% of all hospital admissions for the year. The number of patients ad-

Table 4. Primary Hospital Admissions for Ocular and Related Disease: Most Frequent Nontrauma Diagnostic Categories

Discharge Diagnosis	No. of Patients	Rate, %*	Frequency, %†	ICD-9-CM Code‡
Acute inflammation of orbit	426	2.6	19.9	376.00,01,02
Diplopia and/or nerve palsies	238	1.5	11.1	368.2;378.51,52,53,54,55,56
Optic neuropathies	182	1.1	8.5	377.30,31,32,39,41,42,49
Retinal vascular occlusion and/or transient vision loss	173	1.1	8.1	362.30,31,32,33,34;368.11,12
Eyelid abscess and/or cellulitis	154	0.9	7.2	373.13
Keratitis and/or ulcer	106	0.7	5.0	370.00,03,04,05,06
Malignancy	103	0.6	4.8	172.1;173.1;190.1,03,05,06,08,09
Retinal detachment§	102	0.6	4.8	361.00,01,02,03,04,05,06,07
Endophthalmitis	65	0.4	3.0	360.00,01,02
Visual disturbance or unspecified	64	0.4	3.0	368.8,9
Total	1613		75.4	

Abbreviation: ICD-9-CM, International Classification of Diseases, Ninth Revision, Clinical Modification.

*Rate of annual admission per 100 000 population.

†Percentage based on total number of (ie, 2137) nontraumatic hospital admissions.

‡Codes listed for affirmative discharge diagnoses only.

§Does not include retinopathy of prematurity or exudative retinopathies.

mitted for ocular trauma was even lower (721 admissions), or approximately one third the annual total for nontraumatic admissions. These data confirm what casual observation has suggested for some time—that ophthalmology patients compose a small fraction of inpatient health care. Most eye admissions were not discretionary; they were usually for serious vision-threatening disorders (eg, keratitis), potentially life-threatening disorders (eg, orbital cellulitis), or neuro-ophthalmological emergencies (Table 4).

Hospitals in Florida, on average, admitted 1 patient for nontraumatic eye care per month, which is a relatively low rate, considering the technical experience many of these admissions demand. Low rates of hospital admission might raise quality of care issues because of a possible association between increased patient volume and better clinical outcome, which have been documented across a range of specialties.^{7,8} The volume-outcome relationship has not been specifically studied for urgent or inpatient eye care.^{7,8}

Another finding in this survey that deserves comment was the skewed distribution of length of hospital stay, with fewer than 4% of all hospitalized patients accounting for more than 18% of all hospital-patient days. The average cost of individual hospitalization for this minority of patients was nearly 4 times the overall average. Because of the high cost of inpatient care, insurance carriers no longer allow hospitalization without justification of medical necessity. Prolonged length of stay is probably a reliable surrogate measure of disease severity. A better understanding of the reasons for prolonged length of stay could lead to measures that reduce the risk for extended hospital care. Our ability to more thoroughly study this high-use group, however, was limited with a public access data set. The 2 variables significantly associated with prolonged hospital stay were hospital transfer and facial cellulitis, while the association with Medicaid status approached statistical significance ($P=.07$). Facial cellulitis appears to be a logical sign of more severe inflammation in patients admitted for orbital and eyelid cellulitis.

Table 5. Adjusted Odds Ratios for Prolonged Stay in 1698 Patients*

Variable	Adjusted Odds Ratio (95% CI)†
Age (10-year increase)	1.09 (0.98-1.20)
Male	1.33 (0.82-2.17)
Black race (as compared with white)	1.48 (0.82-2.68)
Medicaid enrollees	1.93 (0.95-3.95)
Emergent or urgent admission (as compared with elective)	1.39 (0.75-2.59)
Hospital transfer	7.38 (3.18-17.13)

Abbreviation: CI, confidence interval.

*Prolonged stay defined as 10 days or longer; 439 patients not included because of incomplete data files.

†Each odds ratio is adjusted for every remaining variable in the table.

The association between Medicaid coverage and increased hospital use suggested by these data is plausible on the basis of the results of other studies.⁹⁻¹² An inverse association of socioeconomic status with disease severity and clinical outcome has been reported for a variety of disorders, but the causes of these relationships are not well understood.¹⁰ Results of some studies suggest that the increase in disease severity found with Medicaid enrollees is because of poor access to outpatient care, which in urban areas is often limited to emergency departments.^{11,12} Medicaid policies that restrict availability to outpatient medications may further increase the risk of disease progression and hospitalization.¹³

The interpretations of the AHCA database are subject to several qualifications. The total number of recorded admissions could include persons who were discharged from one hospital and readmitted shortly thereafter to another. There was no reliable means to identify this type of discharge-readmission transfer. Transfers do not alter the total number of individual admissions during the study year, but they artificially inflate the frequency of some admission diagnoses. Because this data set was a public document, it was not possible to study case-specific information that could have clarified certain findings. For

instance, without a medical record review, there was no means of determining whether a prolonged hospital stay was due to medical necessity or the patient's lack of social support. Given current financial realities, however, it seems unlikely that many prolonged hospitalizations would not be medically justified. The total amount of inpatient eye care is greater than can be estimated by means of simply totaling primary discharge diagnoses because this method does not take into account admissions to veterans hospitals. Without review of the medical record, the interpretation of secondary admission codes is fraught with hazard because there is no method to estimate the clinical relevance (ie, need) for hospitalization, if any, on the basis of a secondary diagnosis.

Logistic regression analysis for prolonged hospitalization excludes patients whose data fields are not complete, which is why data for 439 patients was not included. These 439 patients were similar to the patients included in the analysis with respect to 7 of the 10 most common admission diagnoses. Of the 3 admission diagnoses that were overrepresented in the deleted group, only 1 (retinopathy of prematurity) is related to prolonged length of stay. The potential effect of deleting these patients' data should be small given that retinopathy of prematurity represents only 3% of diagnoses.

Nontraumatic disorders of the eye and ocular adnexa represent a small proportion of all inpatient care in Florida. Few of these patients require prolonged hospitalization but use considerable resources. A better understanding of the risk factors associated with prolonged hospitalization might lead to more effective hospital use and perhaps reduced ocular morbidity.

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Corresponding author: Curtis E. Margo, MD, MPH, Watson Clinic, Ophthalmology, 1600 Lakeland Hills Blvd, Lakeland, FL 33805 (e-mail: cmargo@watsonclinic.com).

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