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Demographic and socioeconomic disparities in receipt of ophthalmology consultation for facial trauma

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ABSTRACT

Objective Functional outcomes following facial and ocular trauma are time-sensitive and require prompt evaluation to minimise long-term vision loss, yet few studies have systematically evaluated disparities in the management of these cases. This study investigates whether a patient's race/ethnicity, primary language, insurance status, gender or age affects receipt of ophthalmology consultation for facial trauma.

Methods and analysis This study was a retrospective cohort analysis of patients from the Elmhurst City Hospital Trauma Registry in Queens, New York who were seen for facial trauma including open globe injuries and orbital fractures between January 2014 and May 2016.

Results Of the 264 patients included, 43% reported as Hispanic, 23% white, 11% Asian, 8% black and 15% other/unknown. After controlling for confounding variables by multivariable logistic regression, neither race/ethnicity, gender, nor primary language were significantly associated with the likelihood of receiving an ophthalmology consult. However, patients with private insurance had 2.57 times greater odds of receiving an ophthalmology consultation than those with Medicaid or state corrections insurance (95% CI 1.37 to 4.95). As age increased, the likelihood of receiving an ophthalmology consultation decreased (p=0.009); patients 60 years of age and older had one-third the odds of ophthalmology consultation as younger patients (OR 0.33; 95% CI 0.16 to 0.68).

Conclusions This study highlights that lack of ophthalmology consultation in patients with facial trauma is linked to age and underinsurance. Extra attention must be paid during primary assessments to ensure elderly patients and those with public insurance have equitable access to timely and appropriate care for facial trauma.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Disparities in access to screening and treatment for retinal disease and glaucoma have been well described. However, disparities within management of ocular trauma have not yet been systematically explored.

WHAT THIS STUDY ADDS

⇒ Our study finds that there are no racial/ethnic disparities in receipt of ophthalmology consultation for facial trauma cases, but that disparities based on age and type of insurance do indeed influence the likelihood of specialised ophthalmological evaluation.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The findings of this study emphasise the need for systematic evaluations of disparities in the management of facial trauma cases to minimise long-term vision loss.

INTRODUCTION

Disparities in healthcare access, use and quality within the USA have been well documented across many settings.[1 2] For example, compared with similarly developed nations with universal healthcare systems such as the UK, the USA has a greater health-income gradient.[3] In the trauma and emergency setting, paediatric patients presenting to an urban emergency department with facial lacerations were less likely to receive subspecialty consultation if they possessed public insurance compared with private insurance.[4] At a publicly funded level 1 trauma centre in Los Angeles, California, adult trauma patients had higher mortality rates if they were younger and uninsured, despite having less severe injuries compared with their older and insured counterparts.[5] Severely injured adult female trauma patients were less likely to be transported or transferred to a trauma centre than similarly injured male patients.[6]

Within ophthalmology, disparities in access to screening and treatments have been described for retinal disease and glaucoma.[7–12] Racial differences in the location and pattern of orbital blowout fractures have also been well studied.[11 12] However, few studies have systematically evaluated inequities in the management of facial trauma and whether demographic and/or socioeconomic disparities exist in the provision of ophthalmology consultation. The incidence of open globe injury is estimated to be 2–3.8/100 000, while orbital fractures comprise approximately 10%–25% of all facial fracture

cases.[13 14] Given that ocular trauma is thus a significant cause of morbidity in the USA, provision of appropriate ophthalmological care in these instances irrespective of patient status is imperative.

Functional outcomes following facial and ocular trauma may be time-sensitive and require prompt care to minimise long-term vision loss. The American Academy of Ophthalmology (AAO) outlines 12 criteria that warrant prompt referral to an ophthalmologist for definitive diagnosis and necessary medical treatment, including failure to achieve normal visual acuity in either eye; significant eye injury, pain or periocular trauma; and tumour or swelling of the eyelids or orbit.[15] The AAO specifically recommends that penetrating or perforating globe injuries be evaluated and treated immediately. For orbital fractures, the AAO endorses a waiting period of 10–14 days before surgical intervention to allow for acute swelling to diminish. Initial and prompt assessment by an ophthalmologist or facial trauma consultant is nonetheless critical, as 11%–15% of orbital fractures are associated with vision-threatening ophthalmologic emergencies.[16–18]

This study investigates whether race/ethnicity, primary language, insurance status, gender or age impacts the receipt of ophthalmology consultation for similar cases of facial trauma.

METHODS

In this retrospective cohort study, patients with International Classification of Diseases, Ninth Revision (ICD-9) codes for open globe injuries and orbital fractures were identified from the Elmhurst City Hospital Trauma Registry between 1 January 2014 and 1 May 2016. Elmhurst Hospital is a level 1 trauma centre in Elmhurst, New York, USA affiliated with the Icahn School of Medicine at Mount Sinai (ISMMS) that serves a population of approximately one million people throughout the ethnically diverse borough of Queens, New York City. The Elmhurst City Hospital Trauma Registry was queried for the following ocular trauma diagnoses which were included in the study: open wound of eyeball, closed fracture of orbital floor (blow-out), open fracture of orbital floor (blow-out), closed fracture of nasal bones, open fracture of nasal bones, closed fracture of other facial bones and open fracture of other facial bones (please refer to table 1 for specific ICD-9 codes used). This study design adheres to the guidelines proposed by the STROBE (Strengthening Reporting of Observational studies in Epidemiology) Initiative[19] for reports of observational studies.

Patients were excluded if the trauma resulted in death or if they were less than 18 years of age. During the study period, 271 patients were identified and included who presented to Elmhurst Hospital Center with the above facial trauma diagnoses. Four patients were excluded due to death, and three excluded for being under 18 years of age. Bias in cohort selection was seemingly limited given the diverse patient population at Elmhurst and minimal exclusion criteria. Furthermore, cohort size was limited by the time-intensive task of manually collating paper charts at the time. Of all patients included, 264 patients were found to have orbital fracture (n=259) and open globe (n=5) injuries and were included in this study for further analysis. This retrospective chart review took note of patient demographics, primary language, insurance status, mechanism of injury, Injury Severity Score (ISS), Glasgow Coma Score (GCS) on presentation, receipt of an ophthalmology consultation, length of hospital stay, length of ICU stay (if applicable), mortality rate and discharge disposition. ISS is an established medical scoring device used to assess trauma severity (table 2). It calculates total injury severity based on the relative severity of each injury across all body regions. The ISS score has been shown to correlate with mortality, morbidity and length of hospitalisation following trauma.

Patient race/ethnicity was self-reported as white, black, Hispanic, Asian or other. Physicians recorded the primary language that was spoken during examination of the patient and whether an interpreter was needed. Patient self-reports of language were used to confirm physician reports. Receipt of an ophthalmology consultation was identified based on records of consultation notes within each patient chart for a given admission.

The main outcome of interest was receipt of an ophthalmology consultation depending on race/ethnicity, primary language, insurance status, gender or age. Age is stratified at age 60 given that New York residents can begin to receive a number of social services (ie,

Table 1 International Classification of Diseases, Ninth revision (ICD-9) ocular trauma codes queried from the Elmhurst City Hospital Trauma Registry

ICD-9	Description	Category	Frequency, n (%)
802.0	Closed fracture of nasal bones	Orbital wall fracture	151 (57.2)
802.1	Open fracture of nasal bones	Orbital wall fracture	3 (1.1)
802.6	Closed fracture of orbital floor (blow-out)	Orbital wall fracture	45 (17.0)
802.7	Open fracture of orbital floor (blow-out)	Orbital wall fracture	2 (0.8)
802.8	Closed fracture of other facial bones	Orbital wall fracture	58 (22.0)
802.9	Open fracture of other facial bones	Orbital wall fracture	0 (0)
871.0–871.9	Open wound of eyeball	Ruptured globe	5 (1.9)

Table 2 Population characteristics of ocular trauma patients during study period

Population characteristics (n=264)	Total population
Age, μ±SD	51.24±22.15
Sex, male, % (n)	77.27 (204)
Race/ethnicity, % (n)	
Non-Latino white	22.81 (60)
Non-Latino black	8.37 (22)
Latino/Hispanic	42.97 (113)
Non-Latino Asian	11.41 (30)
Non-Latino other	14.77 (39)
Primary language, % (n)	
English	61.36 (162)
Spanish	31.44 (83)
Other	7.20 (19)
Insurance stratification, % (n)	
Self-pay	11.28 (29)
Medicaid/corrections	40.47 (104)
All other types	48.25 (124)
Mechanism of injury, % (n)	
Fall	45.08 (119)
MCC	2.27 (6)
MVA	5.30 (14)
Pedestrian struck	9.47 (25)
GSW	0.38 (1)
Stabbing	3.03 (8)
Other assault	27.65 (73)
Bicycle accident	4.17 (11)
Other accident	1.14 (3)
Machine	0.38 (1)
Suicide	0.38 (1)
No of comorbidities, % (n)	
0	21.97 (58)
1	32.20 (85)
2	20.45 (54)
3	12.12 (32)
4+	7.58 (20)
N/A	5.68 (15)
ED disposition, % (n)	89.77 (237)
Discharge	10.23 (27)
Ward/floor	52.27 (138)
Operating room	7.20 (19)
Step-down unit	7.20 (19)
Intensive/critical care unit	23.11 (63)
ED GCS, μ±SD	13.80±2.86
ED eye GCS, % (n)	
No eye opening	5.30 (14)
Eye opening to pain	3.79 (10)
Eye opening to verbal command	4.55 (12)
Eyes open spontaneously	86.36 (228)
ISS, μ±SD	10.30±9.48
ISS>15, % (n)	17.05 (45)
Type of ocular injury, % (n)	
Orbital fracture	98.11 (259)
Ruptured globe	1.89 (5)
Ophthalmology consult, % (n)	30.42 (80)
Other facial trauma consult, % (n)	53.41 (141)

GCS, Glasgow Coma Scale; GSW, Gunshot wound; ISS, Injury Severity Score; MCC, motorcycle crash; MVA, motor vehicle accident; N/A, not available.

Temporary Assistance and Supplemental Nutrition Assistance). Patient characteristics were summarised using percentages for categorical variables, and means and SD for continuous variables. In the primary analysis, univariate and multivariate logistic regression models were used to estimate ORs and 95% CIs for the association between race/ethnicity, primary language, insurance status, gender and age with receipt of ophthalmology consultation (table 3).

Statistical analyses were conducted using both simple (unadjusted) and multivariate (adjusted) logistic regression models. A $p<0.05$ was considered statistically significant. Unadjusted logistic regression compared each predictor individually against the outcome and adjusted logistic regressions compared each predictor against the outcome while controlling for race/ethnicity, primary language, gender, age and ISS.

RESULTS

We identified 264 patients self-reporting as Hispanic (43%), white (23%), Asian (11%), black (8%) or other/unknown (15%) with facial and ocular traumas. Most patients were English speaking (n=162, 61%), followed by Spanish speaking (n=83, 31%). Nineteen patients (7%) spoke another primary language. Additional population characteristics are reported in table 2.

Most patients suffered ocular trauma secondary to mechanical falls (n=119, 45%) and assault (n=73, 28%). Other mechanisms of injury included motor vehicle (n=14, 5%), motorcycle (n=6, 2%), and bicycle accidents (n=11, 4%), stabbings (n=8, 3%), pedestrian struck (n=25, 9%), machine or other accidents (n=4, 2%), gunshot wounds (n=1, 0.4%), and suicides (n=1, 0.4%). The most common diagnoses were closed fractures of the nasal bone (n=151), orbital floor (n=45) or other facial bone (n=58), followed by open fractures of the nasal bone (n=3) or orbital floor (n=2), and ruptured globe diagnoses including laceration with prolapse of

Table 3 Logistic regression model determining whether demographic and socioeconomic factors affect receipt of ophthalmology consultation for ocular trauma

	Unadjusted		Adjusted*	
	95% CI	P value	95% CI	P value
Age	099 (0.98 to 1.00)	0.090	0.98 (0.96 to 0.99)	0.009
Age†				
<60	Reference		Reference	
≥60	0.56 (0.31 to 1.00)	0.051	0.33 (0.16 to 0.68)	0.003
Sex				
Male	Reference		Reference	
Female	1.11 (0.60 to 2.08)	0.735	1.28 (0.62 to 2.61)	0.500
Race/ethnicity				
Non-Latino white	Reference		Reference	
Non-Latino black	1.33 (0.48 to 3.73)	0.584	1.39 (0.44 to 4.20)	0.564
Latino/Hispanic	0.88 (0.44 to 1.76)	0.721	1.32 (0.54 to 3.29)	0.542
Non-Latino Asian	1.90 (0.76 to 4.74)	0.171	1.83 (0.64 to 5.24)	0.254
Non-Latino other	0.83 (0.34 to 2.07)	0.694	0.75 (0.26 to 2.06)	0.583
Primary language				
English	Reference		Reference	
Spanish	0.46 (0.25 to 0.88)	0.018	0.53 (0.23 to 1.18)	0.102
Other	1.95 (0.73 to 5.18)	0.183	2.17 (0.65 to 7.21)	0.200
Payment type‡				
Medicaid and corrections	Reference		Reference	
All other (self-pay, medicare, managed care and private)	1.74 (1.00 to 3.05)	0.052	2.57 (1.37 to 4.95)	0.004
ISS	1.00 (0.97 to 1.03)	0.956	1.03 (0.99 to 1.07)	0.163
GCS	1.18 (1.04 to 1.38)	0.022	1.22 (1.05 to 1.48)	0.020

*Adjusted results hold all other variables constant when comparing rows within a given section. For example, the effect of male or female gender on getting an ophthalmology consultation, holding all other variables constant.
†Age as a categorical variable was used in the model that produced all other results shown here.
‡Compares patients with 'Medicaid and corrections' payment method to patients with 'all other' payment methods.
GCS, Glasgow Coma Scale; ISS, Injury Severity Score.

intraocular tissue (n=2), avulsion (n=1), rupture with intraocular tissue loss (n=1), and unspecified open wound of the eyeball (n=1) (table 1). Of 264 patients, 80 (30%) received an ophthalmology consultation, while 141 (53%) received a consultation by another facial trauma service such as otolaryngology, plastic surgery or oral and maxillofacial surgery. Forty-three patients (16%) received no ophthalmology or facial trauma consults. Overall, insurance stratification was 40% Medicaid/corrections, 11% self-pay and 48% all other types including Medicare, managed care and private insurance.

In an unadjusted univariate logistic regression model, Spanish-speaking patients were significantly less likely to receive ophthalmology consultation than English-speaking patients (19.2% vs 34.0%, OR 0.46, 95% CI 0.25 to 0.88) (table 3). The odds of consultation were significantly greater with greater GCS (OR 1.17, 95% CI 1.04 to 1.38). While not statistically significant, self-pay and privately insured patients were more likely to receive consultations than patients with Medicaid or corrections insurance (44.8% vs 33.1% vs 24%, OR 1.74, 95% CI 1.00 to 3.05). Compared with younger patients, the odds of consultation were nearly half as great among patients aged 60 or older (22.6% vs 34.5%, OR 0.56, 95% CI 0.31 to 1.00). Additional univariate analyses are shown in table 3.

In an adjusted multivariate logistic regression model, patients with private insurance or other payment types were more likely to receive an ophthalmology consultation than patients with Medicaid or state corrections insurance (OR 2.57, 95% CI 1.37 to 4.95). As age increased, the likelihood of receiving an ophthalmology consult decreased when adjusting for covariates (p=0.009), and patients aged 60 or older had approximately one-third the adjusted odds of consultation as younger patients (OR 0.33, 95% CI 0.16 to 0.68). A greater GCS score was also a significant independent predictor of ophthalmology consult (OR 1.22, 95% CI 1.05 to 1.48). While there remained a strong trend towards fewer consultations among Spanish-speaking patients after adjusting for

covariates, this difference was no longer significant (OR 0.53, 95% CI 0.23 to 1.18). There was no significant effect of sex, race/ethnicity or ISS on the likelihood of ophthalmology consultation.

DISCUSSION

Previously, many thought that facial and ocular trauma was a field immune to disparities in care and outcomes due to its inherently acute nature and the universal access to emergency care.[20–22] However, subsequent studies have demonstrated disparities in trauma care based on factors such as race/ethnicity, insurance status, socioeconomic status, gender and age. A 2017 study found that lack of insurance is significantly associated with decreased use of in-hospital and posthospital healthcare services among patients with traumatic brain injury,[23] while another found that older patients are less likely to receive total hip arthroplasty in the management of displaced femoral neck fractures despite evidence that the procedure provides improved clinical outcomes as compared with hemiarthroplasty.[24] Our findings on ocular trauma show similar results, with provision of ophthalmology consultation predicted by insurance status and age. These two factors, thus, clearly present as barriers to equitable ocular care within the public healthcare sphere.

Prior research on disparities within ophthalmology has focused on medical conditions such as glaucoma, retinal disease and cataracts.[7 25] For example, neovascular age-related macular degeneration patients in Australia were less likely to receive antivascular endothelial growth factor injection treatments if they were non-English-speaking and of lower socioeconomic status.[8] Open angle glaucoma patients with Medicaid were less likely to receive appropriate glaucoma testing within the first 15 months of diagnosis compared with patients with commercial health insurance, particularly if they were black compared with other racial/ethnic groups.[7] Race/ethnicity is also a significant risk factor for inadequately corrected refractive error leading to visual impairment, with this risk more pronounced in uninsured patients of low income and educational level.[26]

Our study uniquely focuses on the acute management of ocular trauma, analysing demographic, socioeconomic and clinical factors associated with the provision of ophthalmology consultation. Facial trauma patients who are underinsured are less likely to receive an ophthalmology consultation independent of race, language, age or sex. Given Elmhurst's 2019 Community Health Needs Assessment report stating approximately 70% of its patient population is either uninsured or on Medicaid,[27] the 30% ophthalmology consultation rate in this study may partly reflect the burden on Elmhurst Hospital Center as a safety net for numerous vulnerable populations. This includes patients who do not speak English as their primary language, as Spanish speakers were significantly less likely to receive ophthalmology consultation. Although this difference failed to reach significance on adjusted analysis, this trend is consistent with prior studies that suggest clinicians are less likely to request an ophthalmology consult for non-English speakers.[28]

There have been many proposed approaches to improving the current system, such as diversifying the healthcare workforce, tracking race and ethnicity data to facility public health research, increasing Medicaid reimbursements for eye care, and enhancing health literacy among at-risk populations.[7] With an ageing population worldwide, addressing elder care disparities has also become critical. To this end, incentivising academic careers in geriatric medicine and structured training have been suggested.[1 29] Fall risk reduction remains paramount for patient well-being, and indeed 75% of patients ≥60 had ocular trauma as a result of mechanical fall, compared with 29% of younger patients (in whom assault was the predominant cause of injury, 39%). Given the known association between vision loss and subsequent risk of falls,[30] it is concerning that elderly patients were significantly less likely to receive specialised ophthalmology consultation. While we were unable to assess visual outcomes after discharge in this study due to the limitations of paper chart review, it would be prudent to investigate the impact of ophthalmology consultation in the acute setting on long term visual outcomes in this vulnerable patient population, and to identify targeted areas of intervention to improve the quality of care for elderly patients.

While this study focused on orbital fractures and ruptured globe injuries—in part due to the practical limitations of broadening screening criteria for manual chart review—less severe injuries including traumatic eyelid lacerations, corneal lesions, commotio retinae and vitreous haemorrhage can ultimately become severe if medical attention is delayed,[31 32] and research into the management of such injuries is warranted. It is also true that not every case of orbital fracture requires inpatient consultation, and while 30% of patients had an ophthalmology consult, an additional 53% received consultation by another facial trauma service who may have been able to determine the appropriateness of outpatient versus inpatient ophthalmology evaluation. Of the 43 patients who received no ophthalmology or facial trauma consults, the vast majority (33, 77%) had diagnoses of closed nasal bone fractures. Two of five patients with ruptured globe injuries were not seen by ophthalmology. One patient with reported 'avulsion of the eye' (ICD 871.3) was discharged from the ED and was seen in house by an oral/maxillofacial surgeon, the other with 'unspecified open wound of the eyeball' (ICD871.9) was admitted to the operating room by trauma surgery after evaluation by plastic surgery. These patients likely represent two ends of the triage spectrum, whereby outpatient ophthalmology follow-up is deemed sufficient, or consultation is deferred due to appropriate prioritisation of acute, life-threatening injuries over ocular trauma. Indeed, the odds of ophthalmology consultation decreased significantly with lower GC; however, disposition from the emergency department (discharge, admitted to the floor, operating

room, step-down unit or intensive care unit) was not significantly associated with consultation (p>0.05 for all).

There were several limitations to this retrospective study, including the relatively small sample size and focus on a single institution. At the time of data retrieval in 2019, Elmhurst Hospital Center–whose catchment area includes one of the most ethnically diverse populations in the world,[33] was still reliant on paper charting. Thus, data collection was limited to the relevant admission. Future analysis of presenting symptoms (eye pain, diplopia, etc) and postdischarge visual outcomes could provide further insight into the causes and effects of disparities in consultation. Repeating this work at other institutions and in non-urban settings could also strengthen the generalisability of these findings. Additionally, in this study, injury acuity was evaluated using the ISS, which provides a global overview of injury severity across all body systems. While the ISS is considered a reliable criteria for triaging major versus minor traumas (of note, all patients discharged from the emergency department presented with an ISS<15, while 45 of the 237 admitted patients (19%) had an ISS>15), prior literature has found disparities in outcomes for various types of trauma despite similar ISS, particularly in the elderly.[34] Thus, the use of these criteria is a limitation in this paper. With the standardisation of data entry in EMR, the in future studies the ISS could ideally be replaced by a more appropriate injury grading system such as the Ocular Trauma Score to stratify patients by ophthalmologic severity.

Elmhurst Hospital, with its diverse patient population, can serve as a model for other public hospital systems in the USA. It is crucial to reassess the care provided to at-risk populations, particularly the underinsured and the elderly, who are more likely to experience chronic complications and poverty.[30] On further examination of elderly patients within this study, we find that 32 (39%) of the elderly are also underinsured or uninsured, thus, highlighting again the heightened vulnerability of elderly patients. This vulnerability is worsened by the association between progressive vision loss and increasing Medicare costs, providing ample evidence to reevaluate care for these at-risk patients.[30] Essential measures include counselling on discharge from the emergency room and longitudinal care in primary care settings. Integrating ophthalmology consults into routine care for elderly patients experiencing visual changes after ocular and facial trauma can reduce future emergency room visits, while care discussions on preserving visual health through regular eye exams should be encouraged to prevent ocular traumas due to falls in ageing patients.

In a 2016 study assessing public attitudes on the importance of eye health, 47% of respondents rated losing vision as the worst possible health outcome, equal to or worse than losing hearing, memory, speech or a limb.[35] Given the severity of this issue, our findings suggest that extra attention needs to be paid to elderly patients and those with Medicaid or state corrections insurance during primary trauma assessments to ensure adequate access to specialty care when ocular trauma is present. In conclusion, the disparities identified in ocular trauma care based on insurance status and age highlight the need for targeted interventions to ensure equitable access to ophthalmology consultation, regardless of demographic factors. Addressing these barriers is essential to provide comprehensive and timely care for vulnerable populations.

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Competing interests None declared.

Patient consent for publication Not applicable.

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