



Presence of Medical Conditions that Can Impair Patients with Glaucoma from Administering Topical Glaucoma Medications: A Study Using the Sight Outcomes Research Collaborative (SOURCE) Repository

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BACKGROUND

- Even with no reported difficulties with eye drop instillation, literature shows only about 1/3 of patients can properly self-administer drops^{1,2}
- It can be challenging for patients to consistently administer eye drops due to the force required to squeeze and variations between bottles³
- These difficulties are likely magnified in patients with musculoskeletal, neurologic, or cognitive disorders

PURPOSE

To identify the extent patients with glaucoma, have concomitant systemic medical conditions that can limit the ability to self-administer topical glaucoma medications.

METHODS

Sight Outcomes Research Collaborative Repository (SOURCE)

- SOURCE is a consortium of many academic ophthalmology departments who are sharing 5-10 years of longitudinal, deidentified data on all ocular as well as non-ocular care.
- SOURCE captures patient demographics, eye exam findings, all diagnoses, procedures, labs, medications prescribed, surgeries.
- SOURCE Data Center cleans, aggregates, and harmonizes the data so to be used for research and QI projects



Cohort Identification

In SOURCE, patients with glaucoma were identified by searching ICD billing codes, laser or incisional glaucoma surgeries as captured by CPT-4 codes, and records of prescriptions for topical glaucoma medications.

Covariates

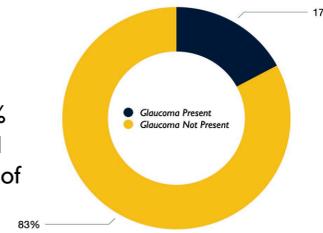
- Health Impairment: represents one or more patient or encounter level diagnoses for 12 medical conditions that would make it difficult to self-administer glaucoma medications. For each patient we tabulated the total number of these health impairments ranging from 0 to 4+.
- Distressed Communities Index (DCI) represents the socioeconomic status of the community where the patient resides. Scores range is from 0 (Very affluent community) to 100 (Least affluent community) and we classified them into four groups.
- Demographics: Age, Sex, Race / Ethnicity

Statistical Analysis

Univariate and multivariable logistic regression modeled the association between outcomes and covariates.

RESULTS

Of the 1.4 million eligible patients in SOURCE 17.1% (n:247,899) had some evidence of glaucoma.



Among these, 42.9% had ≥1 medical comorbidities that can make it difficult to administer glaucoma medications

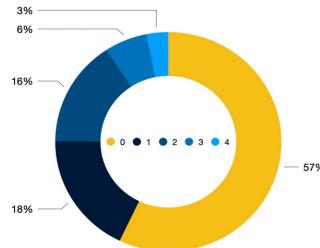


Table 1: Association Between Sociodemographics, Health Impairments, and Glaucoma

Variables	Class	Glaucoma		Odds Ratio (Glaucoma=Yes)	
		No	Yes	Unadjusted	Adjusted
Age	18-54 years	689557 (89.6)	80102 (10.4)		
	55-74 years	414587 (76.4)	127988 (23.6)	2.65 (2.63,2.68)	2.84 (2.81,2.87)
	>=75 years	94186 (70.3)	39809 (29.7)	3.63 (3.58,3.68)	4.07 (4.01,4.13)
Sex	Female	690171 (83.2)	139398 (16.8)		
	Male	508061 (82.4)	108490 (17.6)	1.05 (1.04,1.06)	1.07 (1.06,1.09)
Race/Ethnicity	Non-Hispanic White	813087 (83.9)	155579 (16.1)		
	Non-Hispanic Black	148183 (75.4)	48352 (24.6)	1.70 (1.68,1.72)	2.12 (2.1,2.15)
	Hispanic	49606 (85.4)	8458 (14.6)	0.89 (0.87,0.91)	1.21 (1.18,1.24)
	AM-Indian/Island	5809 (84.9)	1037 (15.1)	0.93 (0.87,0.99)	1.16 (1.08,1.24)
	Others	181645 (84)	34473 (16)	0.99 (0.97,1.00)	1.27 (1.25,1.29)
Any Impairment	No	756260 (84.2)	141492 (15.8)		
	Yes	442070 (80.6)	106407 (19.4)	1.28 (1.27,1.29)	1.15 (1.14,1.17)
DCI Class	0-24.9 (most affluent)	611178 (83.2)	123147 (16.8)		
	25-49.9	245646 (83.5)	48632 (16.5)	0.98 (0.97,0.99)	0.95 (0.94,0.96)
	50-74.9	132894 (82.5)	28192 (17.5)	1.06 (1.04,1.07)	0.97 (0.96,0.99)
	75-100 (least affluent)	115095 (80.8)	27328 (19.2)	1.18 (1.17,1.20)	0.98 (0.96,0.99)

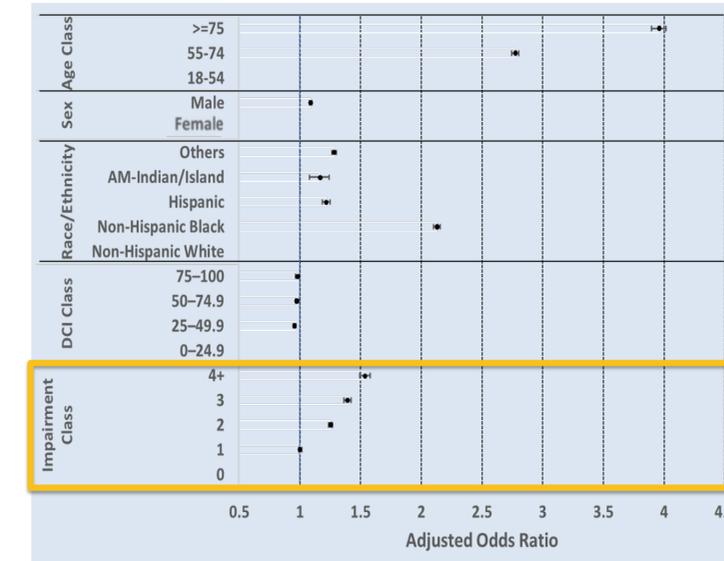
Table 2: Association of Specific Health Impairments with Glaucoma

Impairment Type Present	Glaucoma		P-value
	No	Yes	
Ankylosing Spondylitis	7092 (77.1)	2111 (22.9)	<0.0001
CVA or Stroke	73573 (76.9)	22161 (23.1)	<0.0001
Dementia	19928 (72.3)	7643 (27.7)	<0.0001
Down Syndrome	2431 (82.6)	511 (17.4)	0.7425
Multiple Sclerosis	12347 (89.5)	1442 (10.5)	<0.0001
Osteoarthritis	133361 (74.7)	45138 (25.3)	<0.0001
Paralysis	10016 (83.8)	1937 (16.2)	0.0064
Parkinson	16149 (74.4)	5554 (25.6)	<0.0001
Rheumatoid Arthritis	338739 (79.7)	86166 (20.3)	<0.0001
TBI	59212 (82.1)	12906 (17.9)	<0.0001
Tremors	62929 (79.6)	16093 (20.4)	<0.0001

Analysis of the number of impairments

- Zero-inflated negative binomial model applied to predict the number of impairments.
- Glaucoma significantly increased the chance to have any health impairment (0 vs. 1+).
- Glaucoma significantly increased the risk to have multiple health impairments.

Figure 1: Association Between Number of Health Impairments and Glaucoma.



After adjusting for socio-demographic factors, patients with ≥1 impairment had a 16% increased odds of glaucoma (aOR: 1.16 (1.15, 1.17)) compared to those with no impairments.

Figure 2: Association Between Number of Health Impairments and Odds of Glaucoma



Patients with 2 impairments have a 25%, 3 impairments have a 39%, and 4 or more have a 54% increased odds of glaucoma compared to those with no impairments.

KEY FINDINGS

- Patients with one medical comorbidity have 16% increased odds of glaucoma than those with no impairments when adjusting for sociodemographic factors
- With each additional health impairment, the odds of glaucoma goes up, such that those with 4 or more impairments have a 54% higher odds of glaucoma compared to those with 0 impairments

CONCLUSIONS

43% of patients with glaucoma also have ≥1 comorbidity that can make it difficult to self-administer drops. These patients may benefit from an alternative treatment modality for lowering IOP, such as laser, surgical, or sustained release implants.

REFERENCES

1. Uday B. Kompella, Rachel R. Hartman, Madhoosudan A. Patil, Extraocular, periocular, and intraocular routes for sustained drug delivery for glaucoma, Progress in Retinal and Eye Research, Volume 82, 2021, 100901, ISSN 1350-9462, <https://doi.org/10.1016/j.preteyeres.2020.100901>
2. Stone JL, Robin AL, Novack GD, Covert DW, Cagle GD. An objective evaluation of eyedrop instillation in patients with glaucoma. Arch Ophthalmol. 2009 Jun;127(6):732-6. PMID: 19506189. 10.1001/archophthol.2009.96. PMID: 19506189.
3. Moore DB, Hammer JD, Akhtari R, Beck J, Sanders S, Kryscio RJ. Squeeze Me if You Can: Variability in Force Requirements to Extract a Drop From Common Glaucoma Bottles. J Glaucoma. 2016 Sep;25(9):780-4. 10.1097/IJG.0000000000000506. PMID: 27552516; PMCID: PMC5001908.

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