Prevalence of Dry Eyes in Patients with Common Neurological, Musculoskeletal, and Rheumatological Conditions

A Study Using the Sight Outcomes Research Collaborative (SOURCE) Repository

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FUNDING SOURCES

- NEI R01 EY015473
- NIA R01 AG07258201
- Ocular Therapeutix Grant

SOURCE™
Sight Outcomes Research Collaborative

SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF MICHIGAN

Ocular Therapeutix™

Background

- Proper instillation of eyedrops requires intact coordination, strength, and neurological function
- A variety of common health conditions can make eye drop instillation a challenge [1]
- Complicating matters for these patients, some of these same neurologic, rheumatologic, and musculoskeletal conditions may independently predispose patients to dry eye

Question

Do patients with common neurological, musculoskeletal, and rheumatological conditions have a higher prevalence of dry eye?

Dry eye disease

- One of the most common ophthalmic conditions in US and worldwide [2]
- Treatment varies from behavior modification to medication to office procedures to surgery
- Evaporative vs. aqueous deficient pathophysiology

Purpose

- To study the prevalence of dry eye in patients with various neurological, musculoskeletal, and rheumatological conditions

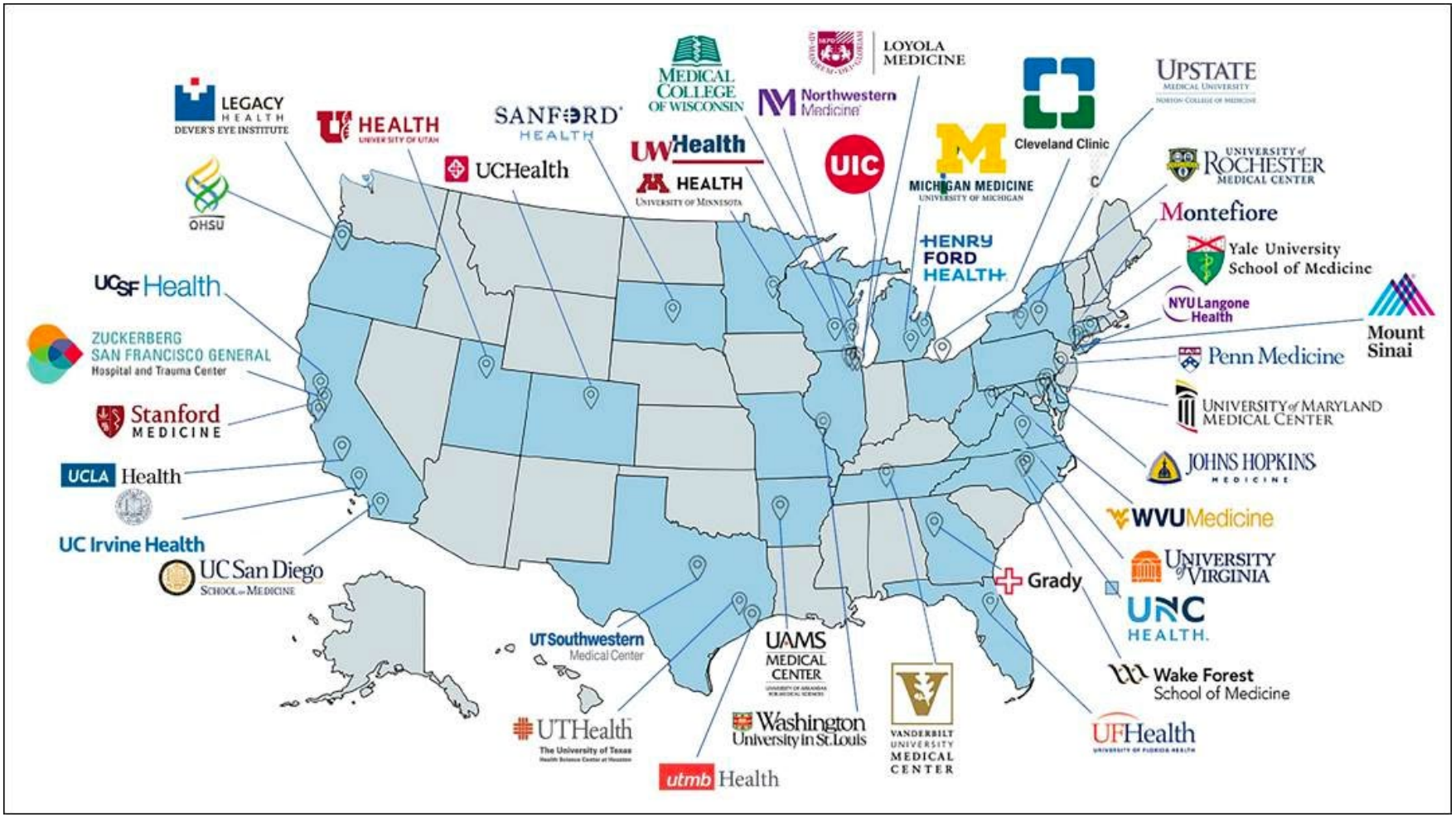
METHODS

Data source

SOURCE™
Sight Outcomes Research Collaborative

- Sight Outcomes Research Collaborative (SOURCE) repository
  - Consortium of academic centers sharing longitudinal EHR data on all eye care recipients
  - SOURCE captures all ocular and non-ocular care for these patients
  - Data deidentified locally and then sent to the Kellogg Eye Center for cleaning, harmonization, and aggregation across sites
  - All data is then made accessible for research projects

Sites Involved in SOURCE



SOURCE Active Sites

Study Sample

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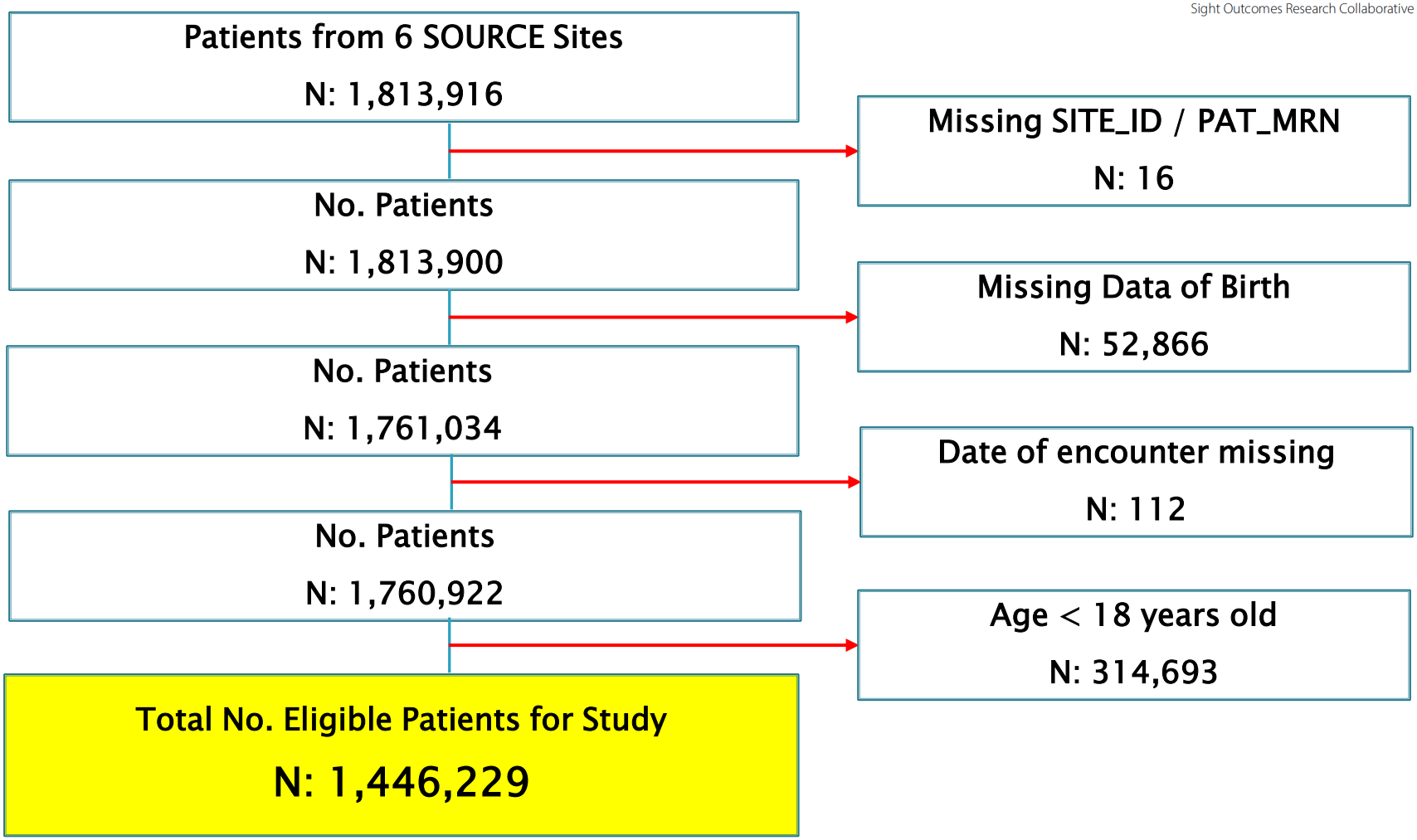
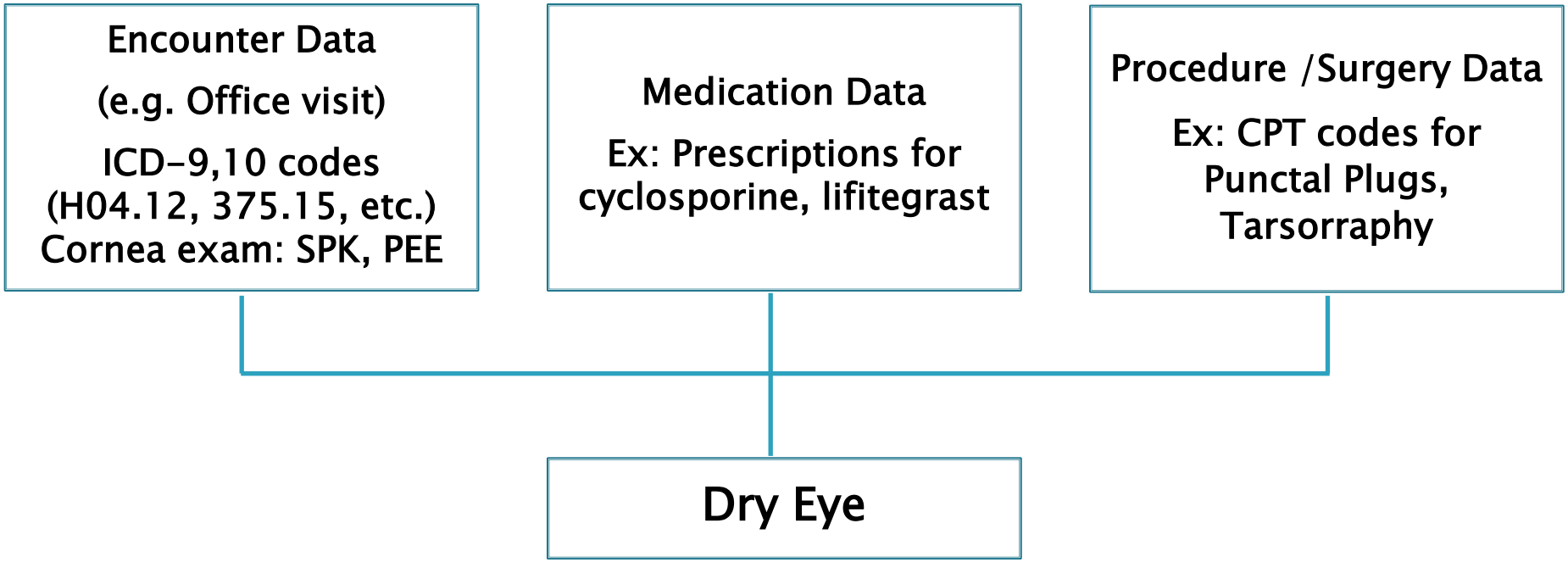


Identifying Patients With Dry Eyes



Variables

- Age

  Categories: 18–54, 55–74, or ≥ 75 years
- Sex

  Female or Male
- Race/Ethnicity

  Non-Hispanic White, Black, Hispanic, American Indian/Islander, Others
- Distressed Community Index
  - Measures community level affluence
  - Score of 0 = most affluent; 100 = least
  - Grouped in quartiles
- Marital status

  Married, Single, Divorced/Widowed, Others

Variables

- Health Impairments
  - 12 Medical Conditions

  - Identified using ICD 9 and 10 Billing Codes

    Tremors, Stroke, Parkinson's Disease, Alzheimer's Disease, Rheumatoid arthritis, Dementia, Multiple Sclerosis, Paralysis, Traumatic Brain Injury, Osteoarthritis, Ankylosing spondylitis, Down's syndrome

  - Summarized two ways

    1) the number of health impairments
       0, 1, 2, 3, and 4+
    2) Any of these impairments vs. none

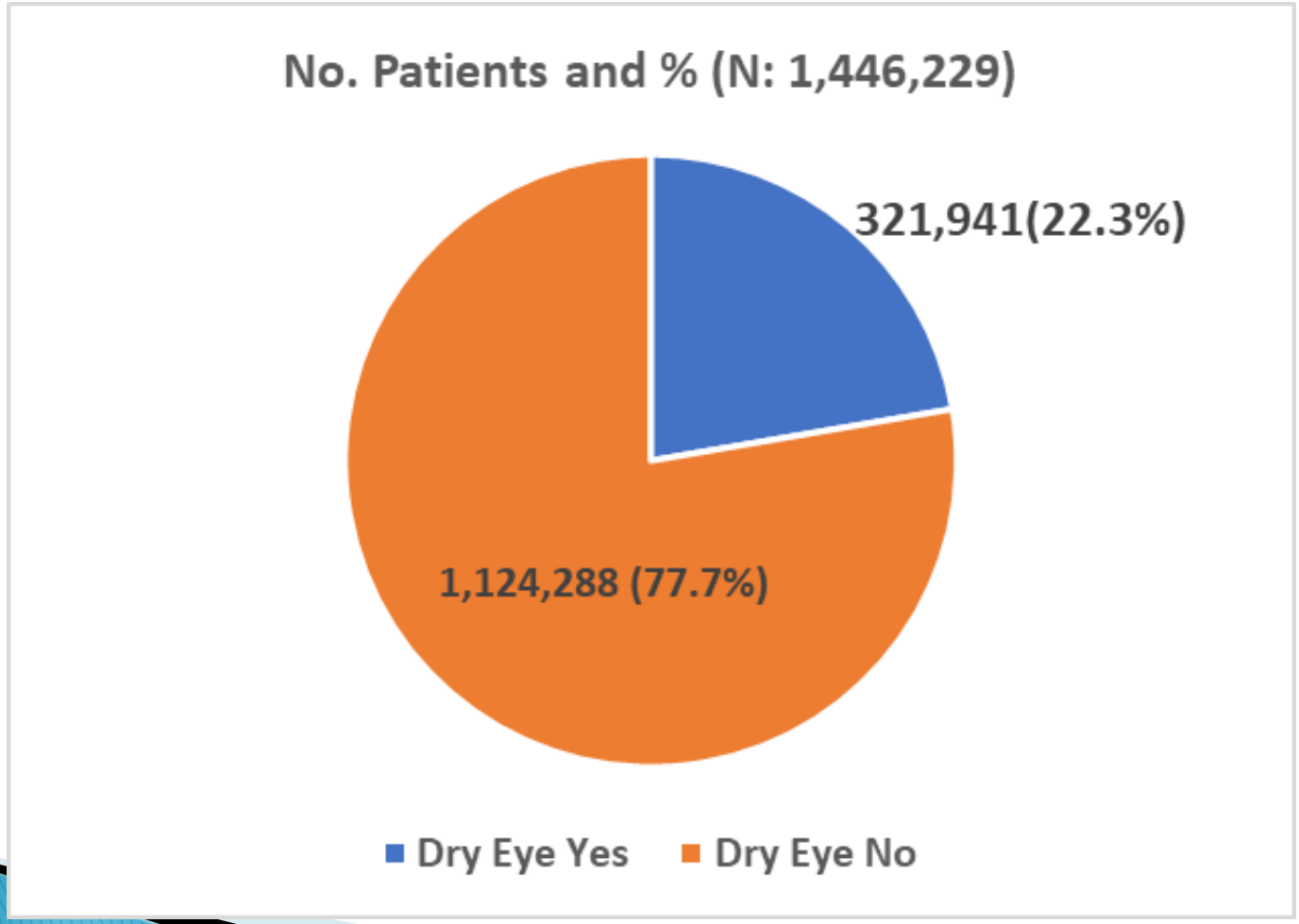
Methods

- Chi-square test for categorical variables applied to examine the association between variables.
- Univariate and multivariable logistic regression applied to examine the association between outcomes and covariates
  - Key predictors: Any health impairment, number of impairments
  - Covariates: Sociodemographic factors

RESULTS

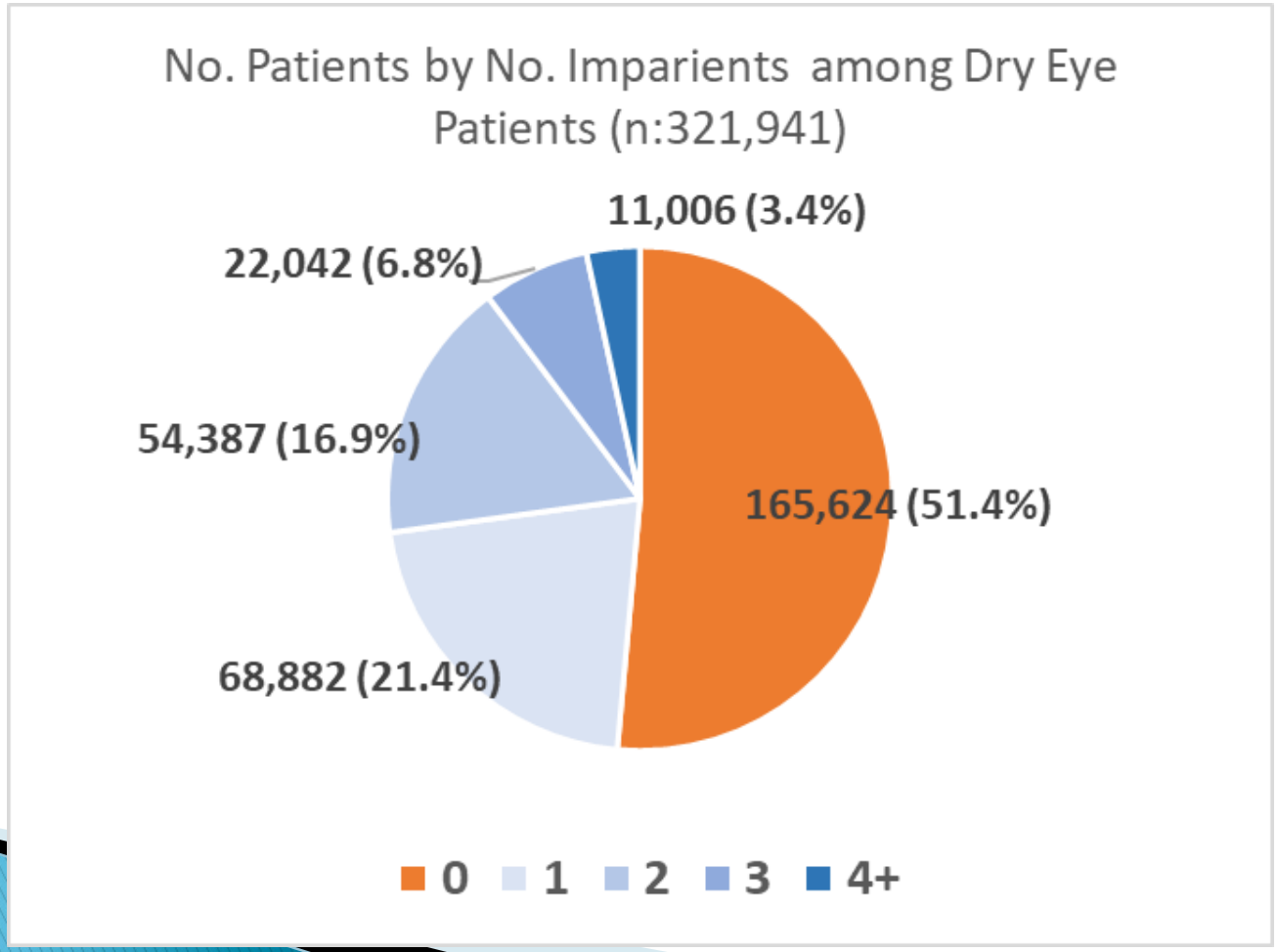
Results

- More than 1 in 5 patients in SOURCE had evidence of dry eye



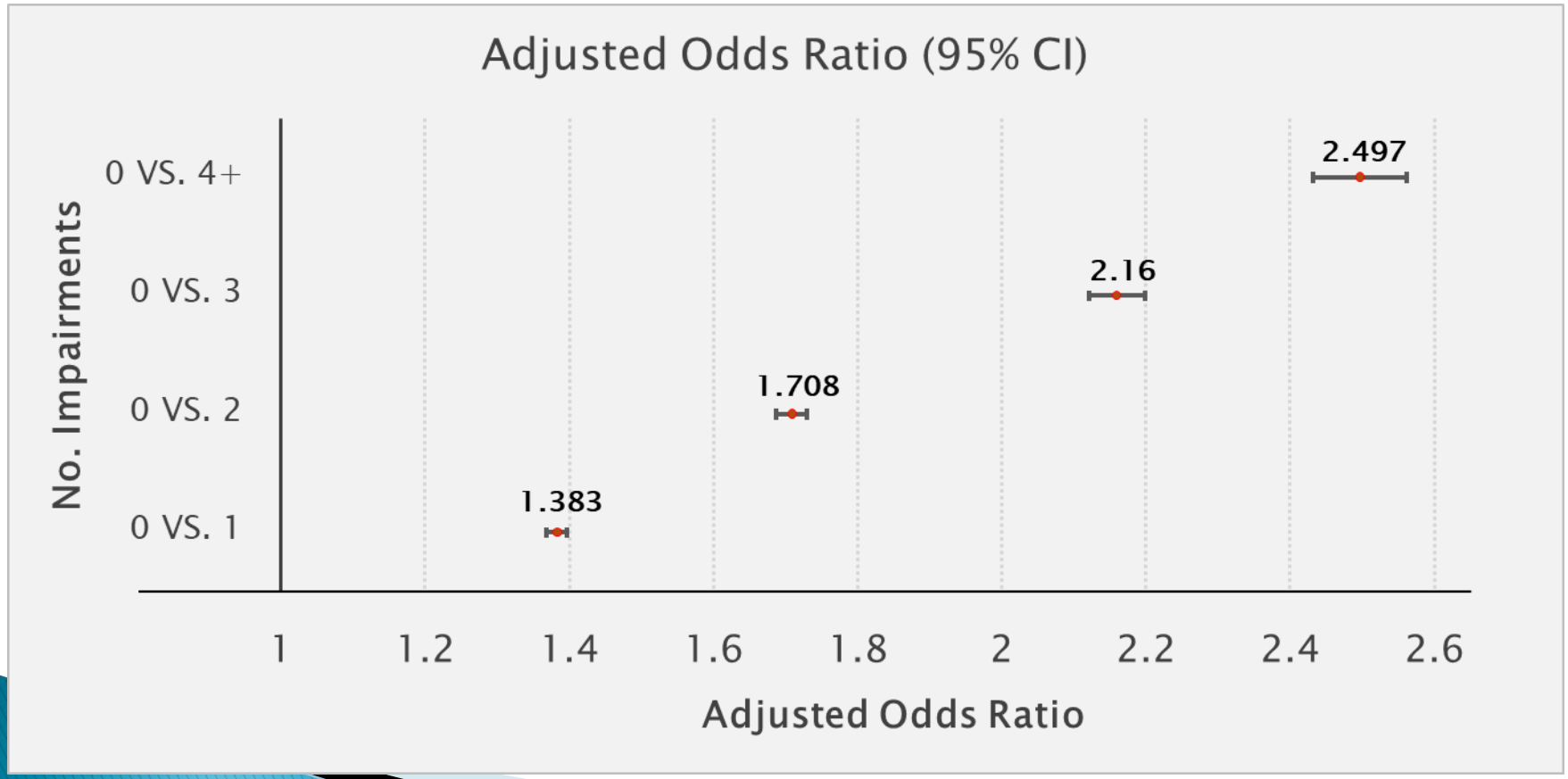
Results

- Nearly 50% of patients documented to have dry eyes had ≥1medical condition making it difficult to administer eye drops



Multivariable Logistic Regression

- After adjusting for potential confounders, patients with ≥1 impairment had a 76% increased odds of dry eyes compared to those with none of these health impairments
- Odds of dry eyes increase substantially with more health impairments



Results

Variables	Class	Dry Eye (N, %)		Odds Ratio (95% CI, For Dry Eye=Yes)	
		No	Yes	Unadjusted	Adjusted
Age Class	18-54	630789 (82)	138870 (18)		
	55-74	394049 (72.6)	148526 (27.4)	1.71 (1.70,1.73)	**1.62 (1.60,1.63)**
	>=75	99450 (74.2)	34545 (25.8)	1.58 (1.56,1.60)	**1.51 (1.48,1.53)**
Sex	F	615719 (74.2)	213850 (25.8)		
	M	508473 (82.5)	108078 (17.5)	0.61 (0.61,0.62)	**0.61 (0.61,0.62)**
Race/Ethnicity	Non-Hispanic White	746019 (77)	222647 (23)		
	Non-Hispanic Black	156098 (79.4)	40437 (20.6)	0.87 (0.86,0.88)	1.00 (0.99,1.02)
	Hispanic	46617 (80.3)	11447 (19.7)	0.82 (0.81,0.84)	1.00 (0.98,1.03)
	AM-Indian/Island	5507 (80.4)	1339 (19.6)	0.82 (0.77,0.87)	**0.87 (0.82,0.93)**
	Others	170047 (78.7)	46071 (21.3)	0.91 (0.90,0.92)	1.08 (1.06,1.09)
DCI Class	0-24.9	558879 (76.1)	175446 (23.9)		
	25-49.9	229186 (77.9)	65092 (22.1)	0.91 (0.90,0.92)	**0.94 (0.93,0.95)**
	50-74.9	127383 (79.1)	33703 (20.9)	0.85 (0.84,0.86)	**0.89 (0.88,0.90)**
	75-100	114693 (80.5)	27730 (19.5)	0.78 (0.76,0.79)	**0.84 (0.82,0.85)**
Marital Status	Married	568615 (76.3)	177024 (23.7)		
	Single	302955 (82.2)	65818 (17.8)	0.70 (0.70,0.71)	**0.82 (0.81,0.83)**
	Divorced/Widowed	151171 (73.6)	54148 (26.4)	1.16 (1.14,1.17)	**0.89 (0.88,0.90)**
	Others	101547 (80.3)	24951 (19.7)	0.79 (0.78,0.81)	**0.89 (0.88,0.91)**
Impairment Class	0	732128 (81.6)	165624 (18.4)		
	1	214253 (75.7)	68882 (24.3)	1.42 (1.41,1.44)	**1.38 (1.37,1.40)**
	2	123397 (69.4)	54387 (30.6)	1.95 (1.93,1.97)	**1.71 (1.69,1.73)**
	3	38534 (63.6)	22042 (36.4)	2.53 (2.49,2.57)	**2.16 (2.12,2.20)**
	4+	15976 (59.2)	11006 (40.8)	3.04 (2.97,3.12)	**2.50 (2.43,2.56)**
Total		1124288 (77.7)	321941 (22.3)		

Key Findings

- Nearly 50% of patients with dry eyes had one or more medical conditions that may make it challenging to self-administer lubricating eye drops
- A sizable number of these patients have multiple medical impairments that can compound the problem of eye drop administration.
- These patients would be excellent candidates for alternative treatments for dry eye

Study Strengths

- Diverse sample of patients receiving care at different sites throughout the US
- Ability to identify patients with dry eyes based on not just billing codes but also exam findings, medications, and procedures.
- Many patients who seek eye care services at tertiary care health systems also receive care for rheumatological or neurological conditions at these same centers

Study Limitations

- Retrospective analysis of previously collected data
- Patients receiving care at large tertiary care centers may have more complex ocular and non-ocular diseases relative to those receiving care in private practice or other settings
- The severity of the health impairments of interest and the extent by which they may be affecting ability to administer eye drops was not considered
  - For example, some patients suffering from strokes become very disabled while others do not.

Conclusions

- A sizable number of patients with dry eyes have one or more medical conditions that may make it challenging to self-administer lubricating eye drops
- The odds of dry eye go up considerably with each additional health impairment
  - The impairments themselves may contribute to dry eyes
  - Systemic medications to treat some of these health impairments can contribute to dry eyes
  - Older age and other factors are also likely contributing
- Many of these patients would likely benefit from alternative treatments for dry eyes that do not require self-administration of eye drops
  - Punctal plugs, implants, sustained release implants, surgical interventions

References

- 1. Sayner R, Carpenter DM, Robin AL, Blalock SJ, Muir KW, Vitko M, Hartnett ME, Lawrence SD, Giangiacomo AL, Tudor G, Goldsmith JA, Sleath B. How glaucoma patient characteristics, self-efficacy and patient-provider communication are associated with eye drop technique. Int J Pharm Pract. 2016 Apr;24(2):78-85. doi: 10.1111/ijpp.12215. Epub 2015 Aug 25. PMID: 26303667; PMCID: PMC5599214.
- 2. Dana R, Bradley JL, Guerin A, Pivneva I, Stillman IÖ, Evans AM, Schaumberg DA. Estimated Prevalence and Incidence of Dry Eye Disease Based on Coding Analysis of a Large, All-age United States Health Care System. Am J Ophthalmol. 2019 Jun;202:47-54. doi: 10.1016/j.ajo.2019.01.026. Epub 2019 Feb 2. PMID: 30721689.
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