

Prevalence and Determinants of Dry Eye Disease among Adults Attending an Ophthalmology Outpatient Department: A Cross-Sectional Observational Study.

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Abstract

Background:

Dry eye disease is a common ocular surface disorder that impairs visual comfort, reading, digital work, and daily functioning. Its burden is increasing in outpatient practice because of ageing, systemic comorbidities, contact lens use, environmental exposure, and prolonged screen-related visual activity.

Objectives:

To estimate the prevalence of dry eye disease and assess its demographic, systemic, ocular, behavioural, and environmental determinants among adults attending an Ophthalmology outpatient department.

Methods:

This cross-sectional observational study was conducted at Prathima Institute of Medical Sciences, Narketpally, Telangana, India, from August 2025 to January 2026. A total of 100 adults were evaluated. Data on age, sex, diabetes mellitus, hypertension, thyroid disorder, contact lens use, previous ocular surgery, screen exposure, and exposure to dust or air conditioning were collected. Dry eye disease and severity were assessed using symptom-based grading supported by ophthalmic evaluation. Associations were examined using chi-square testing and multivariate logistic regression.

Results:

The mean age was 44.9 ± 14.2 years, and females constituted 56.0% of participants. Dry eye disease was present in 42.0% of adults. Mild, moderate, and severe disease accounted for 42.9%, 38.1%, and 19.0% of dry eye cases, respectively. Higher prevalence was observed among older adults, females, diabetics, contact lens users, participants with screen exposure above 4 hours/day, and those exposed to dust or air conditioning. Screen exposure showed the strongest independent association.

Conclusion:

Dry eye disease was common among adult ophthalmology outpatients, with age, female sex, diabetes, contact lens use, prolonged screen exposure, and environmental exposure emerging as relevant determinants.

Recommendations:

Routine screening, early symptom recognition, counselling on screen breaks and blink hygiene, environmental modification, and targeted follow-up for high-risk adults are recommended.

Keywords: Dry eye disease; Ocular Surface Disease Index; Ophthalmology outpatient department; Screen exposure; Contact lens; Diabetes mellitus; Cross-sectional study.

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Introduction

Dry eye disease (DED) is a multifactorial disorder of the ocular surface characterized by tear film instability, ocular discomfort, and disruption of tear film homeostasis. The current definition emphasizes the contribution of hyperosmolarity, ocular surface inflammation, tissue damage, and neurosensory abnormalities to symptom

generation and clinical signs [1]. DED is frequently encountered in ophthalmic practice and has clinical relevance beyond mild irritation, as persistent symptoms affect visual task performance, reading, digital device use, sleep, work productivity, and quality of life. Because the disease has a fluctuating course and a broad symptom

spectrum, many patients present late or use over-the-counter lubricants before formal evaluation.

The reported prevalence of DED varies widely because studies differ in age composition, geography, diagnostic criteria, symptom instruments, and the combination of clinical tests used. The TFOS DEWS II Epidemiology Report documented wide variation in prevalence estimates and highlighted age, female sex, Asian ethnicity, contact lens wear, ocular surgery, systemic disease, medications, digital device exposure, and environmental factors as relevant contributors [2]. Population-based and hospital-based studies have also shown that DED is more frequent in older age groups and women, although clinic-based estimates are often higher than community estimates because symptomatic individuals are more likely to seek ophthalmic care [5-9].

In India, DED has become an important outpatient concern because of urbanization, air pollution, occupational screen use, air-conditioned workplaces, systemic metabolic disease, and increasing cataract and refractive surgical services. Previous Indian hospital-based studies have reported substantial DED burden and have linked disease occurrence to age, female sex, diabetes mellitus, outdoor and indoor environmental exposure, computer use, and ocular factors [9-12]. These determinants are clinically important because several are modifiable through counselling, workplace adaptation, early treatment, and follow-up surveillance.

Diagnosis requires integration of symptoms and ocular surface assessment. The Ocular Surface Disease Index (OSDI) remains a widely used patient-reported tool for evaluating symptom severity and functional impact, and it has demonstrated reliability and validity for clinical and epidemiological use [4]. Contemporary diagnostic guidance recommends symptom assessment along with evaluation of tear film stability, ocular surface staining, tear volume, and meibomian gland status where feasible [3]. In resource-constrained outpatient settings, a structured symptom-based approach combined with focused slit-lamp examination improves case detection without delaying routine clinical services.

The present study was conducted to estimate the prevalence of dry eye disease among adults attending the Ophthalmology outpatient department of Prathima Institute of Medical Sciences, Narketpally, Telangana, India. The objectives were to describe the demographic and clinical profile of the study population, determine the overall prevalence and severity distribution of DED, and evaluate selected determinants, including age, sex, diabetes mellitus, contact lens use, prolonged screen exposure, and exposure to dust or air-conditioned environments.

Materials and Methods

Study design

This was a hospital-based cross-sectional observational study conducted to estimate the prevalence of dry eye disease and to evaluate its associated determinants among adult patients attending the Ophthalmology outpatient department.

Study setting

The study was carried out in the Department of Ophthalmology, Prathima Institute of Medical Sciences, Karimnagar, Telangana, India, from August 2025 to January 2026. The institution is a tertiary-care teaching hospital catering mainly to semi-urban and rural populations of Telangana. The Ophthalmology department provides routine outpatient consultation, ocular surface evaluation, slit-lamp examination, diagnostic services, refraction, cataract-related care, and follow-up services for common anterior and posterior segment disorders. Patient recruitment, clinical evaluation, dry eye symptom assessment, and ocular surface examination were performed within the Ophthalmology outpatient unit. Outpatient nursing and registration staff assisted in patient flow and documentation, while the final clinical assessment was performed by ophthalmology faculty.

Study population

The study population consisted of adult patients aged 18 years and above who attended the Ophthalmology outpatient department during the study period. Patients presenting for routine ophthalmic complaints, refractive evaluation, ocular discomfort, follow-up visits, or general eye examination were screened for eligibility. Consecutive eligible patients were enrolled until the required sample size was achieved.

Eligibility criteria

Inclusion criteria

Adults aged 18 years and above attending the Ophthalmology outpatient department during the study period were included. Patients of either sex who were willing to provide informed consent and who were able to respond to the dry eye symptom assessment were considered eligible.

Exclusion criteria

Patients with acute ocular infection, active ocular trauma, recent chemical injury, severe ocular inflammation requiring emergency care, or severe cognitive impairment preventing reliable symptom assessment were excluded. Patients who were unwilling to participate or who did not provide informed consent were also excluded.

Sample size

The minimum sample size was calculated using the formula for estimating a single proportion:

$$n = Z^2pq/d^2$$

where n is the required sample size, Z is 1.96 at 95% confidence level, p is the expected prevalence, q is $1-p$, and d is the absolute precision. Since previous hospital-based studies from India and other clinical settings have reported variable prevalence of dry eye disease, a conservative expected prevalence of 50% was considered to obtain the maximum required sample size. With 95% confidence level and 10% absolute precision, the calculated sample size was: $n = (1.96)^2 \times 0.50 \times 0.50 / (0.10)^2 = 96.04$

The minimum required sample size was therefore 96. Considering feasibility and to ensure adequate representation, the final sample size was rounded to 100 participants. This sample size was also consistent with hospital-based dry eye studies reported in Indian ophthalmology outpatient populations [9,10,12].

Sampling technique

A consecutive sampling method was used. All eligible adults attending the Ophthalmology outpatient department during the study period were approached in sequence. After confirming eligibility and obtaining informed consent, participants were enrolled until the final sample size of 100 was reached.

Data collection procedure

Data were collected using a predesigned structured proforma. Demographic variables included age and sex. Clinical variables included history of diabetes mellitus, hypertension, thyroid disorder, contact lens use, and previous ocular surgery. Behavioural and environmental exposures included average daily screen exposure and regular exposure to dust or air-conditioned environments. Screen exposure of more than 4 hours per day was considered prolonged. Environmental exposure was recorded when participants reported frequent occupational or household exposure to dust, dry airflow, or air-conditioned surroundings.

Assessment of dry eye disease

Dry eye disease was assessed using symptom enquiry supported by ophthalmic evaluation. Symptom severity was graded using an OSDI-based approach, which is widely used for assessing dry eye symptom burden and functional impact [4]. Participants were categorized as having no dry eye disease, mild dry eye disease, moderate dry eye disease, or severe dry eye disease. Slit-lamp examination and clinical assessment of the ocular surface were used to support the outpatient diagnosis. Diagnostic interpretation followed the accepted principle that dry eye disease involves ocular

symptoms along with evidence of tear film or ocular surface disturbance [1,3].

Bias

Potential sources of bias included selection bias, information bias, recall bias, and observer bias. Selection bias was minimized by using consecutive enrolment of eligible patients attending the outpatient department during the study period. Information bias was reduced by using a structured proforma for the uniform collection of demographic, clinical, behavioural, and environmental variables. Recall bias related to screen exposure, environmental exposure, and previous ocular history was minimized by asking simple, clearly defined questions and by recording only commonly recalled routine exposures. Observer bias was minimized by performing dry eye assessment in a uniform manner within the Ophthalmology department using symptom grading supported by clinical examination. Confounding was addressed during analysis by entering clinically relevant variables into a multivariate logistic regression model.

Statistical analysis

Data were entered and analysed using standard statistical methods. Continuous variables were expressed as mean and standard deviation. Categorical variables were summarized as frequencies and percentages. The prevalence of dry eye disease was calculated as the proportion of diagnosed cases among the total study population. Associations between selected determinants and dry eye disease were tested using the chi-square test or Fisher's exact test where appropriate. Clinically relevant variables were entered into a multivariate logistic regression model, and adjusted odds ratios with 95% confidence intervals were reported. A p -value below 0.05 was considered statistically significant.

Ethical considerations

Institutional Ethics Committee approval was obtained from Prathima Institute of Medical Sciences, Karimnagar, Telangana, India, before initiation of the study. Written informed consent was obtained from all participants. Confidentiality was maintained by using anonymized study records. Participation did not interfere with routine clinical care, and patients diagnosed with DED received appropriate counselling and treatment advice.

Results

Participant flow

During the study period, adult patients attending the Ophthalmology outpatient department were assessed for eligibility. A total of 112 patients were screened. Of these, 12 patients were excluded before enrolment. The reasons for exclusion were acute ocular infection in 4 patients, active ocular trauma in 2 patients, recent chemical injury in 1

patient, severe cognitive impairment preventing reliable symptom assessment in 1 patient, and unwillingness to participate in 4 patients. Thus, 100 eligible participants were enrolled in the study. All enrolled participants completed

symptom assessment and ophthalmic evaluation. There were no incomplete records or post-enrolment exclusions. Therefore, 100 participants were included in the final statistical analysis.

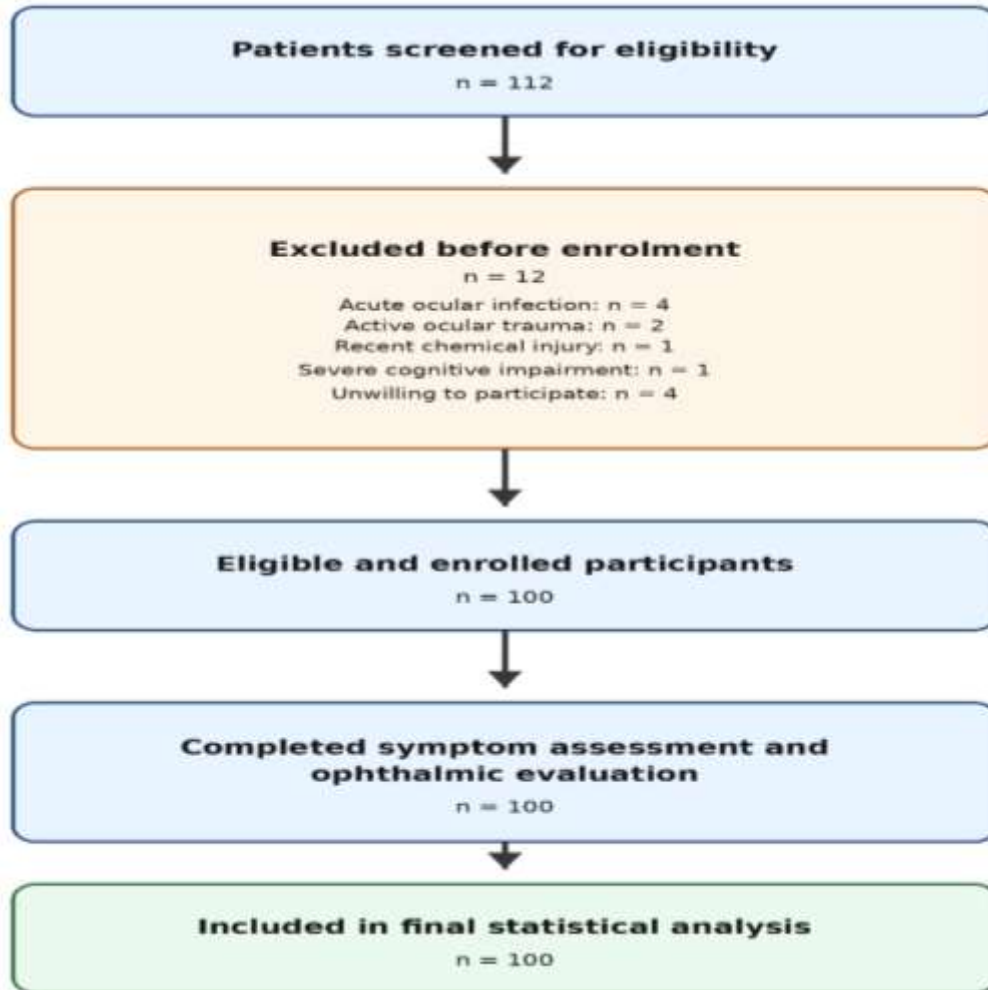


Figure 1: Participant Flow Diagram

A total of 100 adults attending the Ophthalmology outpatient department were included in the study. The mean age of the study population was 44.9 ± 14.2 years. Females constituted 56.0% of the participants. Dry eye disease was identified in 42 patients, giving an overall prevalence of

42.0%. Among affected patients, mild dry eye was observed in 18.0%, moderate dry eye in 16.0%, and severe dry eye in 8.0% of the total study population. The baseline demographic and clinical characteristics are presented in Table 1.

Table 1. Baseline demographic and clinical characteristics of the study population

Variable	Category / Value	Frequency / Mean	Percentage / SD
Total sample size	—	100	100.0
Age, years	Mean ± SD	44.9	±14.2
Age group	18–30 years	22	22.0
	31–45 years	30	30.0
	46–60 years	28	28.0
	>60 years	20	20.0
Sex	Male	44	44.0
	Female	56	56.0
Diabetes mellitus	Present	18	18.0
Hypertension	Present	22	22.0
Thyroid disorder	Present	8	8.0
Contact lens use	Present	12	12.0
Previous ocular surgery	Present	10	10.0
Screen exposure >4 hours/day	Present	46	46.0
Exposure to dust/air conditioning	Present	34	34.0

The prevalence of dry eye disease increased with advancing age. The highest disease burden was observed among participants aged 46–60 years and those above 60 years. Females showed a higher prevalence of dry eye disease compared with males. Dry eye disease was also more

frequent among participants with diabetes mellitus, prolonged screen exposure, contact lens use, and exposure to dust or air-conditioned environments. These associations are shown in Table 2.

Table 2. Prevalence of dry eye disease according to selected determinants

Variable	Category	Total participants	Dry eye disease n (%)	p-value
Age group	18–30 years	22	5 (22.7)	0.018
	31–45 years	30	10 (33.3)	
	46–60 years	28	16 (57.1)	
	>60 years	20	11 (55.0)	
Sex	Male	44	14 (31.8)	0.042
	Female	56	28 (50.0)	
Diabetes mellitus	Absent	82	30 (36.6)	0.031
	Present	18	12 (66.7)	
Contact lens use	Absent	88	34 (38.6)	0.044
	Present	12	8 (66.7)	
Screen exposure	≤4 hours/day	54	15 (27.8)	0.002
	>4 hours/day	46	27 (58.7)	
Dust/air conditioning exposure	Absent	66	22 (33.3)	0.018
	Present	34	20 (58.8)	

Among the 42 participants diagnosed with dry eye disease, mild disease was the most common severity grade, followed by moderate and severe disease. Mild dry eye disease constituted 42.9% of dry eye cases, moderate disease

constituted 38.1%, and severe disease constituted 19.0%. Most severe cases were observed among older adults and participants with prolonged screen exposure or diabetes mellitus. The severity distribution is summarized in Table 3

Table 3. Severity distribution of dry eye disease

Severity of dry eye disease	Frequency	Percentage among the total sample	Percentage among dry eye cases
No dry eye disease	58	58.0	—
Mild dry eye disease	18	18.0	42.9
Moderate dry eye disease	16	16.0	38.1
Severe dry eye disease	8	8.0	19.0
Total dry eye disease	42	42.0	100.0

On multivariate logistic regression analysis, age above 45 years, female sex, diabetes mellitus, screen exposure for more than 4 hours per day, contact lens use, and exposure to dust or air conditioning were independently associated with

dry eye disease. Prolonged screen exposure showed the strongest association with DED, followed by diabetes mellitus and contact lens use. The adjusted odds ratios are presented in Table 4.

Table 4. Multivariate logistic regression analysis of determinants of dry eye disease

Determinant	Adjusted odds ratio	95% confidence interval	p-value
Age >45 years	2.36	1.04–5.38	0.039
Female sex	2.12	1.01–4.72	0.047
Diabetes mellitus	2.89	1.08–7.75	0.034
Contact lens use	2.74	1.01–7.42	0.048
Screen exposure >4 hours/day	3.46	1.51–7.94	0.003
Dust/air conditioning exposure	2.41	1.08–5.39	0.032

Overall, dry eye disease was common among adults attending the Ophthalmology outpatient department, affecting 42.0% of the study population. Increasing age, female sex, diabetes mellitus, contact lens use, prolonged screen exposure, and environmental exposure were significant determinants of dry eye disease in this study.

Discussion

The present cross-sectional observational study found that 42.0% of adults attending an ophthalmology outpatient department had dry eye disease. This finding indicates a considerable clinic-based burden and supports the need for structured DED screening in routine outpatient practice. The observed prevalence is consistent with the wide variation reported globally, where differences in diagnostic definitions, age composition, symptom thresholds, and clinical setting influence estimates [2,5-8]. Indian hospital-based studies have also reported high DED prevalence among ophthalmology attendees, supporting the interpretation that outpatient populations carry a higher symptomatic burden than community samples [9-12]. Age showed a significant association with DED, with higher prevalence among adults older than 45 years. Age-related lacrimal gland dysfunction, reduced tear stability, meibomian gland changes, systemic disease, and medication exposure contribute to ocular surface vulnerability. Similar age gradients have been described in the Beaver Dam Eye Study, the Blue Mountains Eye Study, the Salnes Eye Study, and Indian hospital-based studies [5-7,10,12]. The slightly lower prevalence in participants above 60 years compared

with the 46–60-year group in the present data probably reflects the modest subgroup size rather than a true decline in risk.

Female sex was independently associated with DED. This aligns with established epidemiological evidence showing greater DED frequency in women, particularly after midlife [2,5,6]. Hormonal variation, autoimmune susceptibility, tear film lipid changes, and health-seeking behaviour are plausible explanations. Diabetes mellitus was another important determinant. Diabetes can affect the ocular surface through corneal nerve dysfunction, tear secretion impairment, altered epithelial healing, and inflammation, and published reviews have described DED as a clinically relevant diabetic ocular surface manifestation [13]. Therefore, routine dry eye enquiry should be incorporated into diabetic eye evaluation along with retinal assessment. Screen exposure above 4 hours per day demonstrated the strongest independent association with DED. Digital screen use reduces blink rate, increases incomplete blinking, and prolongs interblink intervals, thereby increasing tear evaporation and tear film instability [14]. Contact lens use also showed an independent association. Lens wear alters tear film dynamics, increases frictional stress, and contributes to ocular surface discomfort, especially in patients with pre-existing tear film instability [2]. Dust and air-conditioned environments were significantly associated with DED, supporting the role of environmental desiccation and irritant exposure in outpatient symptom burden.

The predominance of mild and moderate disease suggests that many cases are detectable at a stage suitable for

counselling, lubrication, ergonomic modification, and follow-up. This has practical value for outpatient departments because brief symptom screening can identify high-risk adults without extensive resource use. The results also reinforce the need for patient education on screen breaks, conscious blinking, contact lens hygiene, glycaemic control, and avoidance of direct dry airflow.

Generalizability

The findings are most applicable to adult ophthalmology outpatients in tertiary-care settings with similar demographic, occupational, and environmental profiles. Because participants were recruited from a hospital outpatient department rather than the community, the observed prevalence reflects clinic-based disease burden rather than population prevalence. Still, the determinants identified, particularly screen exposure, diabetes, female sex, and contact lens use, are biologically plausible and align with multicentric evidence, supporting relevance for comparable Indian outpatient settings.

Conclusion

Dry eye disease was identified in 42.0% of adults attending the Ophthalmology outpatient department at Prathima Institute of Medical Sciences, indicating a substantial clinic-based burden. Most affected participants had mild or moderate disease, suggesting an opportunity for early recognition and preventive counselling. Increasing age, female sex, diabetes mellitus, contact lens use, prolonged screen exposure, and exposure to dust or air-conditioned environments were significant determinants. Screen exposure above 4 hours per day showed the strongest independent association. Routine symptom screening, targeted assessment of high-risk adults, and simple behavioural and environmental interventions can improve timely detection and reduce persistent ocular discomfort in outpatient practice.

Limitations

This study was conducted in a single tertiary-care outpatient department with a sample size of 100, limiting population-level inference. The cross-sectional design restricts causal interpretation. Symptom grading depended on outpatient assessment and participant recall of exposures. Detailed tear osmolarity, meibography, and longitudinal follow-up data were not included, which restricts the mechanistic interpretation of disease subtypes.

Recommendations

Ophthalmology outpatient departments should include brief dry eye screening for adults, especially those above 45 years, females, diabetics, contact lens users, and individuals with prolonged screen exposure. Patients should be counselled regarding the 20-20-20 rule, conscious blinking,

adequate hydration, avoidance of direct air flow, regular breaks during screen work, and correct contact lens hygiene. Diabetic patients should undergo ocular surface assessment during routine eye examination. Workplaces and study environments should promote screen ergonomics and reduce air-conditioned dryness. Patients with moderate or severe symptoms require early ophthalmology follow-up and individualized treatment.

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Abbreviations

DED: Dry eye disease
OSDI: Ocular Surface Disease Index
TFOS: Tear Film and Ocular Surface Society
DEWS: Dry Eye Workshop
OPD: Outpatient department
CI: Confidence interval
AOR: Adjusted odds ratio
SD: Standard deviation

Conflict of interest

The authors declare no conflict of interest.

Author contributions

BJ -Concept and design of the study, results interpretation, review of literature, and preparation of the first draft of the manuscript. Statistical analysis and interpretation, revision of manuscript.

NVLM- Design of the study, results interpretation, review of literature, preparation of the first draft of the manuscript, and revision of the manuscript.

Data availability

Data Available

Author Biography

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