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Temporal Trends in Ophthalmic Disease Presentation in Gombe State, Nigeria: A Year- And Month-Based Analysis

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ABSTRACT

Temporal and seasonal patterns in ophthalmic disease presentation are important for healthcare planning, but evidence from northeastern Nigeria is limited. This study assessed annual and monthly trends in ophthalmic presentations at Specialist Hospital Gombe over five years. A retrospective analysis was conducted using records of 9,199 patients seen between January 2021 and May 2025. Data were analysed by year, month, diagnosis, and age group. Descriptive statistics summarised distributions, while the Mann–Kendall, Kruskal–Wallis, and Chi-square tests assessed temporal trends, monthly variation, and categorical associations, respectively, with significance set at $p < 0.05$. Annual attendance declined from 2,846 patients in 2021 to 2,168 in 2025, a 23.8% reduction, but this did not represent a significant monotonic trend ($p = 0.9306$). Monthly attendance varied significantly ($p < 0.001$), peaking in October (1,636 patients) and reaching its lowest level in December (338 patients), a 4.8-fold difference. Corneal ulcer showed the largest proportional increase (+754.5%), but this was not statistically significant ($p = 0.1020$). Descriptive seasonal variation was also observed for allergic conjunctivitis, infectious conjunctivitis, dry eye disease, and ocular trauma. Overall age distribution varied significantly across the study period, although changes within individual age groups were not significant. Ophthalmic service utilisation at Specialist Hospital Gombe showed marked monthly variation but no significant long-term annual trend. These findings may inform workforce planning, clinic scheduling, medication procurement, and future surveillance. Prospective multicentre studies incorporating environmental, climatic, and behavioural data are recommended.

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INTRODUCTION

Visual impairment and blindness remain major public health challenges, affecting quality of life, education, productivity, and health systems. The World Health Organization estimates that at least 2.2 billion people globally live with visual impairment or blindness, many of which are preventable or treatable through timely eye care [1]. As populations grow and age, demand for ophthalmic services is expected to rise, particularly in resource-constrained low- and middle-income countries. Understanding healthcare utilisation patterns is therefore essential for service planning, workforce allocation, and equitable access to eye care.

Temporal epidemiology helps show how disease burden and service use change over time. Annual trend analysis can reveal shifts in demand, emerging disease patterns, and resource needs, while monthly or seasonal analysis can guide staffing, medication forecasting, service scheduling, and targeted health education [2]. This is especially relevant in ophthalmology, where several conditions vary with environmental, behavioural, and healthcare-seeking factors.

Seasonal variation has been reported for several eye conditions. Allergic conjunctivitis often increases with airborne allergens, dust, and low humidity [3], while dry eye disease is linked to dry conditions that increase tear evaporation and ocular surface irritation [5]. Infectious conjunctivitis may occur in temporal clusters, particularly during periods of close interpersonal contact such as school terms [4,10]. Ocular trauma may also fluctuate with occupational, agricultural, and outdoor activities, although patterns vary by region [6].

Nigeria's geographical and climatic diversity may influence ocular disease patterns. Studies from different regions have shown variations in ophthalmic disorders related to demographic, environmental, occupational, and healthcare-access factors [7,8]. However, most Nigerian studies describe disease distribution among hospital attendees rather than changes in attendance and presentation over time. Evidence on long-term temporal trends and seasonal fluctuations therefore remains limited, especially in northeastern Nigeria.

Gombe State lies in the Sudan Savanna ecological zone and has three main climatic periods: Harmattan (November–February), marked by dry, dusty Saharan winds; a hot dry season (March–May); and a rainy season (June–October). These periods involve changes in temperature, humidity, dust exposure, agricultural activity, and population movement. West African studies suggest that such conditions may influence ocular surface disorders, including allergic conjunctivitis [3,9]. However, because environmental exposure, healthcare-seeking behaviour, and socioeconomic factors interact in complex ways, seasonal findings from retrospective facility-based studies should be interpreted cautiously.

Understanding temporal variation in ophthalmic presentations has practical value for clinical and health system management. Predictable changes in attendance can support workforce planning, medication procurement, equipment maintenance, and preventive health education. Changes in the frequency of specific conditions can also guide surveillance and inform prospective studies on environmental and behavioural risk factors.

Despite its importance, annual and monthly trends in ophthalmic disease presentation have not been comprehensively evaluated at Specialist Hospital Gombe, a major ophthalmic referral centre in northeastern Nigeria. Addressing this gap can improve understanding of local service use and support data-driven planning.

This study analysed annual and monthly trends in ophthalmic disease presentation among patients attending Specialist Hospital Gombe between 2021 and 2025. It examined overall attendance, diagnosis-specific trends, age distribution, and monthly patterns, while exploring seasonal variation in common conditions. As a retrospective observational study, it identifies temporal associations but cannot establish causal links between environmental conditions and disease occurrence. The findings aim to support local ophthalmic service planning, resource allocation, and future research on seasonal eye disease patterns in northeastern Nigeria.

METHODS

This retrospective observational study assessed temporal trends in ophthalmic disease presentation among patients attending the Ophthalmology Department of Specialist Hospital Gombe (SSHG), Gombe State, Nigeria, between January 2021 and May 2025. SSHG is a major referral centre providing comprehensive ophthalmic services to Gombe State and neighbouring communities. Data were extracted from electronic medical records and clinic registers. Records with complete information on date of presentation, age, and primary diagnosis were included; duplicates and incomplete or inconsistent entries were excluded. Extracted variables were year and month of presentation, age, and primary ophthalmic diagnosis. Age was grouped as 0–5, 6–10, 11–15, 16–20, 21–30, 31–40, 41–50, 51–60, and ≥61 years. All identifiers were removed before analysis.

Descriptive and inferential statistics were used to evaluate annual and seasonal patterns. Annual volumes, monthly variation, diagnosis-specific frequencies, and age-group distributions were summarised using frequencies, percentages, means, and standard deviations where appropriate. Annual and diagnosis-specific trends were assessed with the Mann–Kendall trend test, monthly differences with the Kruskal–Walli's test, and categorical associations, including age distribution by year, with the Pearson Chi-square test. Statistical significance was set at two-sided $p < 0.05$; non-significant findings were interpreted as insufficient evidence of a temporal trend. Ethical approval was obtained from the Specialist Hospital Gombe Institutional Review Board (Approval No. SSHG/IRB/2025/001). Informed consent was waived because anonymised retrospective routine data were analysed in accordance with the Declaration of Helsinki.

RESULTS

A total of 9,199 patients attended the Ophthalmology Department of Specialist Hospital Gombe between 2021 and 2025 and were included in the temporal trend analysis. The findings are presented according to annual patient attendance, monthly patterns of presentation, diagnosis-specific trends, and age distribution.

Yearly Patient Volume Trends

Annual patient volumes at Specialist Hospital Gombe showed marked year-to-year fluctuation but **no statistically significant monotonic trend** over the study period. Annual attendance was **2,846** in 2021, **494** in 2022, **2,145** in 2023, **1,546** in 2024, and **2,168** in 2025 (Table 1), yielding a total of **9,199** patients and an average annual attendance of **1,840 ± 789**. Although the numeric change from 2,846 patients in 2021 to 2,168 patients in 2025 represents a **23.8%** reduction, the Mann–Kendall test did not detect a significant monotonic trend (p = **0.9306**), indicating that the observed year-to-year variability reflects irregular fluctuations rather than a consistent long-term increase or decrease.

Despite this apparent reduction in annual attendance, the **Mann–Kendall trend test showed no statistically significant monotonic temporal trend** (**$p = 0.9306$**). The observed year-to-year fluctuations therefore indicate variability in clinic attendance rather than evidence of a consistent long-term increase or decrease in patient volume. The average annual attendance during the study period was **1,840 ± 789** patients, with a median annual attendance of **2,145** patients. Linear regression analysis similarly demonstrated a shallow negative slope (-30.4 patients per year) with a very low coefficient of determination (**$R^2 = 0.003$**), indicating that calendar year explained very little of the variation observed in patient attendance.

The largest year-to-year decline occurred between **2021 and 2022**, when patient attendance decreased by **82.6%**, whereas the greatest increase occurred between **2022 and 2023**, with an increase of **334.2%**. These marked fluctuations contributed to the absence of a statistically significant overall temporal trend despite the numerical reduction observed across the study period.

Table 1: Yearly Patient Volume Summary

Year	Patients	Change from Previous
2021	2,846	N/A
2022	494	-82.60%
2023	2,145	334.20%
2024	1,546	-27.90%
2025	2,168	40.20%

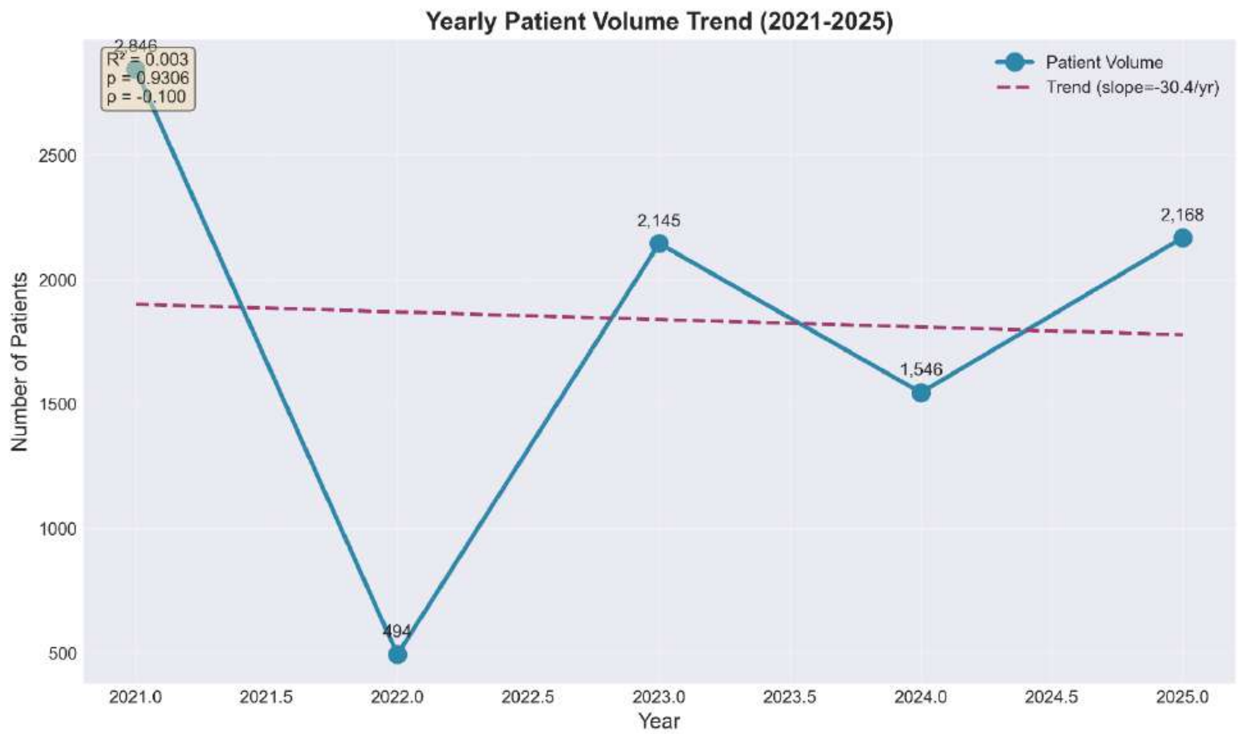

Figure 1: Yearly patient volume at SSHG ophthalmology clinic (2021-2025). Patient volume decreased significantly by 23.8% over the study period.

Monthly/Seasonal Patterns

Monthly attendance exhibited clear seasonal variation. Cumulative monthly counts show a peak in October (1,636 patients; 17.8%) and a trough in December (338 patients; 3.7%), representing approximately a 4.8-fold difference between the highest and lowest months (Table 2). The Kruskal–Wallis test confirmed that monthly differences were statistically significant ($H = 1946.61$; $p < 0.001$), supporting the presence of meaningful within-year variation in service utilisation. These monthly patterns—notably high attendance in October and July and low attendance in November–December—have operational implications for staffing, clinic scheduling, and supply forecasting.

The observed monthly differences were statistically significant (Kruskal–Wallis H = 1946.61; $p < 0.001$), indicating substantial seasonal variation in clinic attendance across the calendar year. Relatively high attendance was also observed during July (13.4%), whereas comparatively lower attendance occurred during November (4.5%) and December (3.7%). These findings demonstrate that ophthalmic service utilisation varied considerably by month during the study period.

Table 2: Monthly Patient Distribution (VERIFIED)

Month	Patients	% of Total	Status
January	851	9.30%	
February	909	9.90%	
March	699	7.60%	
April	488	5.30%	
May	575	6.30%	
June	685	7.40%	
July	1,230	13.40%	
August	744	8.10%	
September	627	6.80%	
October	1,636	17.80%	🔴 PEAK
November	417	4.50%	
December	338	3.70%	🔵 TROUGH

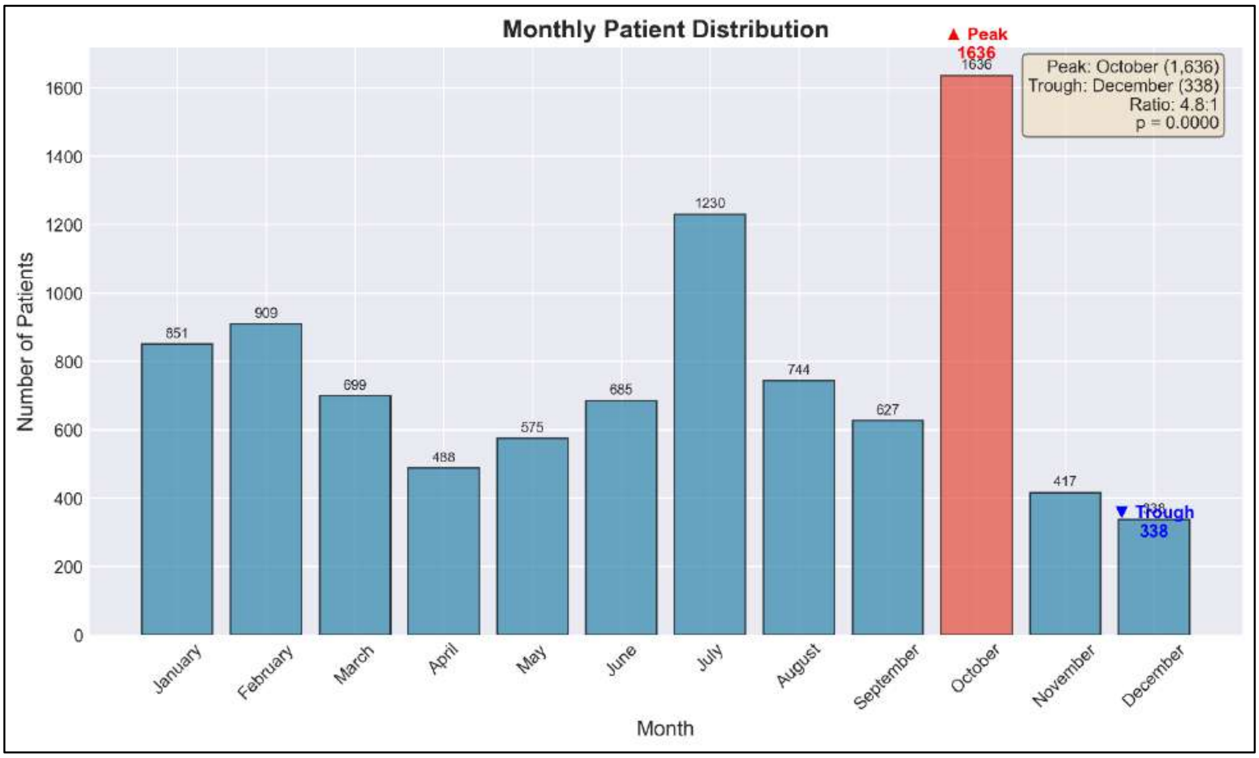

Figure 2: Monthly patient volume at SSHG ophthalmology clinic. Peak attendance occurs in October (1636 patients), while trough occurs in December (338 patients).

Diagnosis-Specific Temporal Trends

Diagnosis-specific counts changed numerically for several conditions but none of the individual diagnosis trends reached statistical significance. For example, corneal ulcer increased from 11 cases in 2021 to 94 cases in 2025 (+754.5%; $p = 0.1020$), while refractive error decreased from 305 to 258 cases (−15.4%; $p = 0.9643$). Other conditions (allergic conjunctivitis, cataract, bacterial conjunctivitis, ocular trauma, itching, discharge) showed numerical increases or decreases consistent with the table values but without statistical confirmation of trend. These descriptive shifts warrant continued surveillance and, where appropriate, targeted investigation to determine whether they reflect true epidemiologic change, altered care-seeking, or data artefact.

Table 3: Diagnosis Trends

Diagnosis	First Year	Cases (First)	Last Year	Cases (Last)	Growth	Sig.	p-value
Corneal Ulcer	2021	11	2025	94	754.50%	✗	10.20%
Itching	2021	52	2025	98	88.50%	✗	68.20%
Trauma	2021	43	2025	50	16.30%	✗	82.55%
Discharge	2021	60	2025	65	8.30%	✗	99.28%
Refractive Error	2021	305	2025	258	-15.40%	✗	96.43%
Allergic Conjunctivitis	2021	1085	2025	914	-15.80%	✗	0.895
Cataract	2021	280	2025	178	-36.40%	✗	0.6701
Bacterial Conjunctivitis	2021	321	2025	184	-42.70%	✗	0.591

Seasonal Distribution of Common Ophthalmic Conditions

Descriptive analyses suggested variation in the monthly distribution of several ophthalmic conditions throughout the year. Allergic conjunctivitis occurred more frequently during the Harmattan period (November to February), while infectious conjunctivitis showed relatively higher frequencies around January–February and September. Dry eye disease and blepharitis were observed more commonly during the dry season, whereas ocular trauma appeared to occur more frequently during periods corresponding to increased outdoor occupational activities.

Because this study did not incorporate environmental, meteorological, occupational, or behavioural data, these observations should be interpreted as descriptive temporal associations rather than evidence of causal relationships. Additional prospective studies incorporating environmental exposure measurements would be required to determine the factors contributing to these seasonal patterns.

Age Distribution Trends Over Time

Age composition of clinic attendees changed in composition across years ($\chi^2 = 164.94$; $p < 0.001$), but changes within many individual age bands were not statistically significant. The combined paediatric proportion (0–15 years) declined from 15.70% in 2021 to 11.00% in 2025, a 4.7 percentage-point decrease (not 2.3 points as previously stated). The proportion aged ≥61 years rose from 6.5% to 11.4% (a 4.9 percentage-point increase). While the overall age distribution shift is significant, interpretation of changes in single age bands should be cautious because individual band comparisons were not uniformly significant.

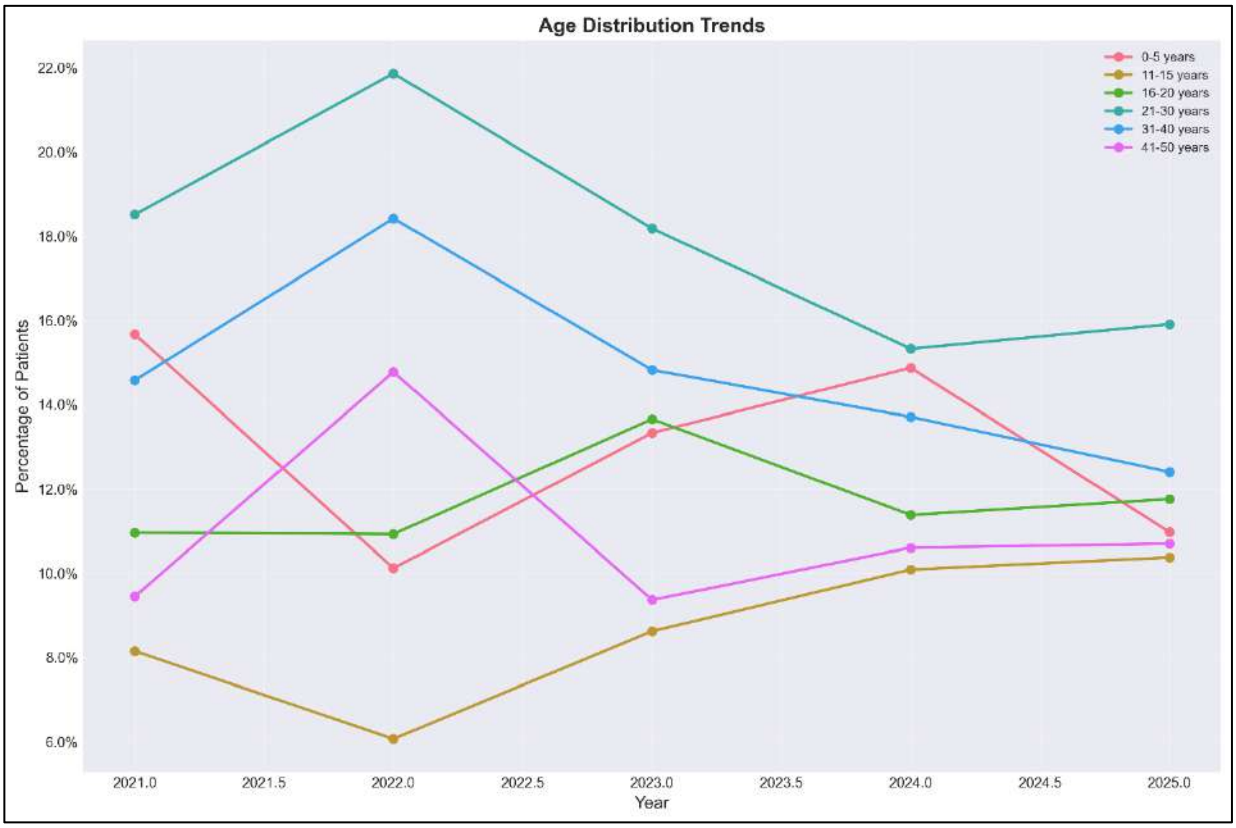

Figure 3: Age Distribution of patients at SSHG ophthalmology clinic

Table 4: Age Distribution by Year

Year	0-5 yrs	6-10 yrs	11-15 yrs	16-20 yrs	21-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs	61+ yrs
2021	15.70%	8.70%	8.20%	11.00%	18.50%	14.60%	9.50%	7.40%	6.50%
2022	10.10%	4.00%	6.10%	10.90%	21.90%	18.40%	14.80%	4.50%	9.30%
2023	13.30%	9.50%	8.60%	13.70%	18.20%	14.80%	9.40%	6.50%	6.00%
2024	14.90%	8.60%	10.10%	11.40%	15.30%	13.70%	10.60%	8.00%	7.40%
2025	11.00%	8.90%	10.40%	11.80%	15.90%	12.40%	10.70%		

CONCLUSION AND RECOMMENDATIONS

This retrospective analysis of 9,199 ophthalmic clinic attendances at Specialist Hospital Gombe (January 2021–May 2025) found no statistically significant monotonic annual trend despite a numeric decline from 2,846 patients in 2021 to 2,168 in 2025 (−23.8%). In contrast, monthly attendance varied significantly, with a clear peak in October (1,636; 17.8%) and trough in December (338; 3.7%), indicating important seasonal variation in service utilisation. Diagnosis-specific and age-group changes were largely descriptive; notable numeric changes (for example, corneal ulcer rising from 11 to 94 cases) did not reach statistical significance and therefore require further surveillance and prospective study to determine causality.

Recommendations

1. Use monthly attendance patterns (peak: October; trough: December) to guide workforce deployment, clinic scheduling, and medication/equipment procurement.
2. Strengthen routine surveillance and consider prospective data collection (including environmental and occupational variables) to investigate the large numeric rise in corneal ulcer presentations.
3. Continue to monitor age-group composition and diagnosis frequencies; where numerical changes persist across multiple years, plan targeted audits or operational responses.

Conflicts of Interest: None declared.

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