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Patient Flow Through a Tertiary Emergency Eye Clinic: Referral Characteristics, Diagnostic Concordance, and Subspecialty Referral Patterns

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Abstract

Background

Emergency eye clinics (EECs) play an important role in providing acute ophthalmic care and facilitating access to subspecialty services. In Canada, EECs at tertiary centres are largely managed by ophthalmology residents under staff supervision. This study aimed to characterize one year of care at a tertiary EEC by describing referral patterns and diagnostic case mix, evaluating diagnostic concordance between referral and initial EEC diagnoses, and quantifying the frequency and distribution of subsequent subspecialty referrals.

Methods

This observational study combined prospective referral data collection with retrospective chart review. Consecutive referrals received by fax on weekdays at the Kingston Health Sciences Centre EEC between July 1, 2024, and July 1, 2025, were included. Referral data were collected prospectively, and data from the initial EEC encounter were abstracted retrospectively. Variables included referral source, patient demographics, time to assessment, examination findings, proposed or rule-out diagnosis, and subsequent subspecialty referral. Diagnostic concordance was assessed by comparing the referring provider's diagnosis with the initial EEC diagnosis. Univariable and multivariable analyses were used to identify factors associated with diagnostic concordance and subspecialty referral.

Results

Among 1,280 referrals, the most common sources were family medicine (44.2%), optometry (22.5%), and emergency medicine (15.0%). Median time to assessment was 3 days (IQR 1–8). Referrals documented visual acuity in 37.5%, intraocular pressure in 17.5%, pupil findings in 10.2%, anterior and/or posterior segment findings in 28.3%, and a proposed or rule-out diagnosis in 42.3%. Among

BACKGROUND

Urgent ophthalmic presentations are common and often require timely assessment, close follow-up, and referral to subspecialty care [1–6]. In Canadian tertiary centres, emergency eye clinics (EECs) provide access to acute ophthalmic assessment and management. Many are primarily staffed by ophthalmology residents under staff ophthalmologist supervision and receive a high volume of referrals from diverse healthcare providers. At Kingston Health Sciences Centre (KHSC), the EEC serves as an important entry point for patients across southeastern Ontario and as far north as James Bay with acute and, at times, chronic ophthalmic concerns [7]. Understanding the clinic's diagnostic case mix and subsequent demand for subspecialty care can inform service planning, resource allocation, and residency education.

Because EECs receive referrals from diverse healthcare providers, the quality and diagnostic accuracy of referral information may influence both initial triage and subsequent care pathways. Effective triage and patient flow depend in part on high-quality referral information, including a targeted ocular history, focused ophthalmic examination, and clear documentation of key findings [8–10]. However, one study reported an accurate referral ophthalmic diagnosis in only 45% of referrals [11]. A previous retrospective analysis from our institution developed a referral completeness checklist and examined referral completeness, triage urgency, and concordance between provisional triage impressions and final diagnoses in a five-month subset of referrals included in the present study [12]. Referral completeness varied widely overall and across referring professions [12].

Building on our earlier work, the present study examined the full prospective cohort to (1) characterize referral patterns and diagnostic case mix in an EEC; (2) evaluate diagnostic concordance between referral and initial EEC diagnoses and identify variables associated with concordance; and (3) quantify the frequency and subspecialty distribution of referrals initiated after the initial EEC visit and identify variables associated with downstream subspecialty referral. Together, these analyses describe the EEC's role in assessing referred patients and facilitating access to subspecialty care, with implications for clinical service delivery and resident training.

1. METHODS

2.1 Ethical Statement and Consent

This study was reviewed and approved by the Health Sciences Research Ethics Board at Queen's University, Ontario, Canada (file number 6041268) and was conducted in accordance with the Declaration of Helsinki. Given the observational nature of the study, patient consent was not obtained. Patients who had opted out of participation in research, as documented in their electronic medical records, were excluded.

2.2 Study Design

This prospective observational study was conducted at the EEC at KHSC, Hotel Dieu Hospital (HDH) site (clinical trial number: not applicable). All weekday EEC referrals received by fax between July 1, 2024, and July 1, 2025, were included and triaged by a single ophthalmology resident as part of routine clinical care. Referrals were excluded if they bypassed resident triage, including direct pager referrals without accompanying paper documentation and Emergency Department direct bookings. Weekend and statutory holiday assessments were also excluded because referral documentation could not be reliably captured during those periods.

2.3 Data Collection

Data were collected from two sources: prospectively from faxed referral documentation and retrospectively through standardized chart review of the initial EEC encounter in the electronic medical

record. Referral variables included referring provider profession and city of practice, patient age and sex, visual acuity, pupil assessment, intraocular pressure, anterior and/or posterior segment examination findings, and the proposed and/or rule-out diagnosis. Examination-related variables were coded as reported if documented for either eye.

Referring providers were categorized as ophthalmology, optometry, emergency medicine, family medicine, medical specialties (internal medicine and its subspecialties), surgical specialties, other medical specialties, and other health professions. Time from referral to initial EEC assessment was calculated in days, with assessments occurring on the same calendar day as the referral assigned a value of 0 days. Chart review variables included the diagnosis assigned at the initial EEC visit, whether EEC follow-up was arranged, and whether subspecialty consultation was required. Subspecialty referrals were recorded only if they were initiated after the initial EEC assessment and the receiving subspecialty service was documented.

2.4 Classification of diagnoses and concordance determination

Proposed and/or rule-out diagnoses identified during resident triage, as well as diagnoses documented at the initial EEC encounter, were independently classified using anatomical categories. This approach was chosen because referral diagnoses were often heterogeneous, incomplete, or framed as broad rule-out concerns, making exact diagnosis-level comparison difficult. Categories included lid/lacrimal/adnexa, orbit, conjunctiva/sclera/episclera, cornea, anterior segment, lens/capsule, optic nerve/glaucomatous processes, posterior segment, optic nerve/neuro-ophthalmology/motility, panocular, normal or baseline examination, and no anatomical location specified. Diagnostic concordance was defined as agreement between the anatomical category assigned to the referring provider's proposed or rule-out diagnosis and the anatomical category assigned to the initial EEC diagnosis. Concordance was analyzed as a binary outcome: concordant versus discordant.

2.5 Statistical Analysis

Categorical variables are presented as counts and percentages, while continuous variables are reported as mean with standard deviation or median with interquartile range, based on data distribution. Univariable associations with diagnostic concordance and subsequent subspecialty referral were assessed using the Pearson chi-square test for categorical variables and the Mann–Whitney U test for continuous variables. Multivariable logistic regression was performed to identify factors independently associated with each outcome. Clinically relevant variables and those associated with the outcome on univariable analysis were considered for inclusion. Multicollinearity was assessed before modelling, and collinear variables were not entered simultaneously; the most clinically relevant and interpretable predictor was retained. Because some provider categories represented less than 5% of the total sample, selected groups were combined for analysis. Ophthalmology was retained as a separate category despite its small sample size because of its clinical relevance. Analyses were performed using IBM

SPSS Statistics version 31, and graphs were created using GraphPad Prism version 11.0.0. Two-sided p values < 0.05 were considered statistically significant.

2. RESULTS

3.1 Cohort Characteristics, Referral Sources, and Distribution of EEC Diagnoses

A total of 1,280 referrals were included and are summarized in Table 1. The median age was 59.0 years (IQR 39.0–69.0) and 54.4% of patients were female (692/1,272). The median time from referral to initial assessment in the EEC was 3 days (IQR 1–8). Referrals were most commonly received from Family Medicine (44.2%; 564/1,277), followed by Optometry (22.5%; 287/1,277) and Emergency Medicine (15.0%; 192/1,277). The median distance from the referring provider's practice address to the EEC was 10 km (IQR 10–48 km). Most referrals originated within 15 km of the EEC (63.6%), while 22.9% came from 46–99 km away.

Initial EEC diagnoses spanned all anatomical categories. The most common were posterior segment pathology (19.5%), corneal disease (18.8%) and normal ocular examination/no pathology (16.6%) while 3.5% could not be assigned to a specific anatomical category.

3.2 Referral Content for Ocular Examination Elements and Proposed Diagnosis

Referral documentation was assessed by provider type (Table 2). Overall, visual acuity was documented in 37.5% of referrals, IOP in 17.5%, and a pupil examination in 10.2%. Documentation of either an anterior and/or posterior segment examination was present in 28.3% of referrals while a proposed diagnosis and/or rule-out diagnosis was specified in 42.3% of referrals. Stratified by profession, visual acuity, IOP and pupil assessment were most frequently documented in optometry referrals (78.7%, 66.2% and 20.9%, respectively). A proposed and/or rule-out diagnosis was most frequently specified by other medical specialties (54.8%) and emergency medicine (54.7%).

3.3 Diagnosis Documentation and Concordance Patterns

Of the 542 (42.3%) referrals documenting a proposed or rule-out diagnosis, the most proposed anatomical category was posterior segment (n = 140), followed by optic nerve/motility (n = 87) and cornea (n = 70). A total of 66 referrals did not specify an anatomical location of pathology (e.g., foreign body, trauma, nevus). Diagnostic concordance was reached in 323 referrals (59.5%) and differed significantly by anatomical category ($\chi^2(11) = 142.4$, $p < 0.001$). Figure 1 depicts concordance rates stratified by proposed anatomical category. Concordance was highest for lens/capsule (81.8%), posterior segment (80.0%), and cornea (75.7%). Among referrals classified as "not specified" for anatomical location (n = 66), the most common diagnoses assigned at the initial EEC visit were cornea (42.4%) and normal ocular examination (19.7%).

3.4 Variables Associated with Diagnostic Concordance

Diagnostic concordance differed significantly by provider type ($\chi^2 = 33.681$, $p < 0.001$), with the highest rates observed among referrals from ophthalmology (81.0%), optometry (73.0%), and emergency medicine (64.2%). Concordance was also more frequent when referrals documented visual acuity, intraocular pressure, or anterior and/or posterior segment examination findings ($p = 0.030$, $p = 0.003$, and $p = 0.012$, respectively). Concordant referrals were assessed sooner than discordant referrals (median 2 days [IQR 1–5] vs 3 days [IQR 1–7], $p = 0.003$), and concordant patients were older on median (62.0 vs 56.5 years, $p = 0.018$). No significant associations were observed for sex, pupil assessment documentation, abnormal pupil findings, referral distance, quantitative visual acuity, or intraocular pressure measurements. Full univariable results are presented in Table 3.

3.5 Subspecialty Referral Patterns

Following the initial EEC encounter, 493 of 1,280 patients (38.5%) were scheduled for at least one follow-up visit in EEC based on the initial assessment, and 349 of 1,280 (27.3%) were referred onward for ophthalmology subspecialty evaluation. Among subspecialty referrals, the most common was retina (116/349), followed by comprehensive ophthalmology (95/349) and neuro-ophthalmology (45/349).

3.6 Variables Associated with Subspecialty Referral

Subspecialty referral differed significantly by provider type ($\chi^2 = 45.609$, $p < 0.001$), with the highest rates observed among referrals from ophthalmology (43.1%) and optometry (40.4%). Referral was also more frequent among male patients (30.7% vs 24.7% for females, $p = 0.017$) and when referrals documented visual acuity, intraocular pressure, or anterior and/or posterior segment examination findings ($p = 0.039$, $p < 0.001$, and $p = 0.001$, respectively). Abnormal pupil findings were more common among patients requiring subspecialty assessment (44.3% vs 25.4%, $p < 0.001$). Patients referred onward had a longer median time from referral to EEC assessment (4 days [IQR 1–10] vs 3 days [IQR 1–8], $p = 0.004$), were older (64.0 years [IQR 47.0–73.8] vs 57.0 years [IQR 37.0–68.0], $p < 0.001$), and had significantly different visual acuity in both eyes (both $p < 0.001$). Pupil assessment documentation, rule-out diagnosis documentation, referral distance, and intraocular pressure measurements were not significantly associated with subspecialty referral. Full univariable results are presented in Table 4.

3.7 Multivariable Analysis of Diagnostic Concordance and Subspecialty Referral

In multivariable logistic regression, the diagnostic concordance model was statistically significant overall ($\chi^2 = 37.509$, $df = 7$, $p < 0.001$). Compared with referrals from Other Medical/Surgical Specialties, referrals from ophthalmology, optometry, and emergency medicine had greater odds of diagnostic concordance (ophthalmology: OR 5.16, 95% CI 1.47–18.07, $p = 0.010$; optometry: OR 3.68, 95% CI 1.82–7.42, $p < 0.001$; emergency medicine: OR 2.38, 95% CI 1.16–4.87, $p = 0.018$).

The subspecialty referral model was also statistically significant overall ($\chi^2 = 69.534$, df = 11, $p < 0.001$). Independent factors associated with subspecialty referral included optometry referral source compared with Other Medical/Surgical Specialties (OR 2.07, 95% CI 1.16–3.69, p = 0.014), abnormal pupil examination findings (OR 2.19, 95% CI 1.30–3.69, p = 0.003) and assessment more than 3 days after referral (OR 1.60, 95% CI 1.20–2.14, p = 0.001). Older age was independently associated with referral, with an 11% increase in odds for every 10-year increase in age (OR 1.11, 95% CI 1.04–1.19, p = 0.003). Male sex was also significantly associated with subspecialty referral (OR 0.724, 95% CI 0.550–0.953, p = 0.021).

3. DISCUSSION

This study characterized referral patterns, diagnostic case mix, and subsequent referral pathways in a resident-led regional EEC. Posterior segment and corneal disease were the most common pathological categories, while approximately one in six patients had a normal ocular examination. Among referrals documenting a proposed or rule-out diagnosis, anatomical diagnostic concordance was approximately 60% and varied by referring profession. Following the initial EEC assessment, 38.5% of patients were scheduled for further EEC follow-up and 27.3% were referred onward, most commonly to retina, comprehensive ophthalmology, and neuro-ophthalmology. Together, these findings describe the EEC's role in providing initial assessment, ongoing management, and access to further ophthalmic care.

The diagnostic case mix and subsequent referral patterns have implications for clinical service planning and residency education. The frequency of posterior segment and corneal disease supports a strong training emphasis on their assessment and initial management. The substantial proportion of patients scheduled for further EEC follow-up also indicates that clinic capacity must accommodate both new referrals and ongoing care. Meanwhile, the distribution of referrals identifies where coordination with retina, comprehensive ophthalmology, and neuro-ophthalmology services may be particularly valuable.

Of the minority of referrals that included a suspected or rule-out diagnosis, concordance with the diagnosis assigned at initial ophthalmic assessment was present in approximately 6 in 10 cases. Concordance was highest for lens/capsule, posterior segment, and corneal diagnoses, indicating that agreement varied substantially across anatomical categories. These findings should be distinguished from exact diagnosis-level accuracy, because concordance was assessed using an anatomical classification framework. Prior literature has also documented variability in ophthalmic referral diagnostic accuracy across different settings [8,11,13].

Provider type also remained associated with diagnostic concordance after adjustment for age and time to assessment. Concordance was highest among referrals from ophthalmology and optometry in univariable analysis, and referrals from ophthalmology, optometry, and emergency medicine had greater adjusted odds of concordance than those from the reference group of other medical/surgical specialties. Differences across provider groups may reflect variation in ophthalmic training, equipment access, diagnostic case mix, and referral threshold. Previous studies have identified limited

ophthalmology exposure during medical school and residency, as well as low confidence among non-ophthalmologist trainees and physicians in performing basic ophthalmic examinations and managing eye complaints [14–20]. Educational outreach tailored to referring providers may therefore be valuable. Studies of targeted ophthalmology education have demonstrated improvements in learner comfort and confidence, although effects on referral accuracy and patient outcomes require further evaluation [21].

Referral documentation provides additional context for these concordance findings. Fewer than half of referrals included a proposed or rule-out diagnosis, and documentation of visual acuity, intraocular pressure, and anterior and/or posterior segment examination findings was associated with greater concordance in univariable analyses. These findings complement the earlier institutional study of referral completeness and triage by describing individual documentation elements within the full cohort [12]. Although some examination elements require specialized equipment or expertise, visual acuity and a gross description of external or anterior segment abnormalities can often be obtained in low-resource referral settings [22]. Omission of these findings, along with the absence of a focused diagnostic impression, may reduce triage precision in high-volume urgent eye care [10,23–25]. Standardized referral templates and targeted education may help improve the consistency of information available for assessment and triage. Templates have improved referral completeness in other clinical settings[26,27] but whether such interventions improve diagnostic concordance, triage decisions, or patient outcomes in this setting requires further evaluation.

Several factors were also associated with subsequent subspecialty referral. Optometry referrals had higher adjusted odds of subspecialty referral, which may reflect more specific ophthalmic assessment before EEC presentation or referral of patients more likely to require specialist care. Older age and abnormal pupil findings were also independently associated with onward referral, although the mechanisms underlying these associations were not established. The association between assessment more than 3 days after referral and subspecialty referral should be interpreted cautiously. Because subspecialty referral was captured only when initiated at the initial EEC encounter, patients seen sooner may have been managed with short-interval EEC follow-up before a final disposition decision, whereas less acute but chronic conditions may have been triaged later and then referred onward. The association does not establish that a longer assessment interval increases the need for subspecialty care. Rather, it may reflect differences in case mix, triage prioritization, and management pathways.

This study adds to literature by prospectively evaluating referrals from multiple provider groups within a resident-triaged EEC, applying a structured anatomical framework for diagnostic concordance, and characterizing onward referral patterns after the initial EEC assessment [11,23,25,28,29]. Strengths include prospective referral capture in a real-world clinical setting and standardized diagnostic classification. Limitations include the single-centre design, restriction to weekday faxed referrals, potential selection bias from restricting concordance analyses to referrals with a documented diagnosis, and use of anatomical rather than exact diagnosis-level concordance. In addition, subspecialty referral was captured only when initiated at the initial EEC visit; referrals made during subsequent follow-up and

longer-term clinical outcomes were not assessed. The referral distribution therefore represents initial onward referral patterns rather than total subspecialty demand.

Future studies should evaluate complete patient pathways, including subsequent EEC visits, subspecialty assessments, and clinical outcomes. Linking referral characteristics and initial disposition with treatment requirements, time to definitive care, and visual outcomes would help clarify the clinical significance of the observed associations. Evaluating referral templates and educational interventions within these pathways could also determine whether improvements in documentation translate into better triage and patient care.

4. Conclusion

This regional EEC assessed a broad spectrum of ophthalmic conditions, most commonly posterior segment and corneal disease. Anatomical diagnostic concordance was 59.5% among referrals documenting a proposed or rule-out diagnosis and varied by referring profession and anatomical category. More than one-quarter of patients were referred onward after the initial EEC assessment, most frequently to retina, comprehensive ophthalmology, and neuro-ophthalmology. These findings highlight the EEC's role in both initial ophthalmic assessment and facilitating access to further care, and can inform clinical service planning and residency training priorities.

Table 1
Patient characteristics, referral sources, and initial EEC diagnoses

Variables of interest	All Referrals
Age, years; median (IQR)	59.0 (39.0–69.0)
Females, n/N (%)	692/1272 (54.4)
Males, n/N (%)	580/1272 (45.6)
Time from referral to initial EEC assessment, days; median (IQR)	3.0 (1.0–8.0)
Provider type, n/N (%)	
Ophthalmology	51/1277 (4.0)
Optometry	287/1277 (22.5)
Emergency Medicine	192/1277 (15.0)
Family Medicine	564/1277 (44.2)
Medical specialities	48/1277 (3.8)
Surgical specialities	13/1277 (1.0)
Other medical specialities	42/1277 (3.3)
Other professions	80/1277 (6.3)
Distance to HDH by provider location, n/N (%)	
< 15km	807/1268 (63.6)
15km-45km	63/1268 (5.0)
46-99km	291/1268 (22.9)
100km-250km	34/1268 (2.7)
250km-500km	13/1268 (1.0)
> 500km	60/1268 (4.7)
Distance to HDH by provider location, km; median (IQR)	10.0 (10.0–48.0)
EEC diagnoses by anatomical classification n/N (%)	
Lids/Lacrimal/Adnexa	114/1280 (8.9)
Orbit	19/1280 (1.5)
Conjunctiva/Sclera/Episclera	97/1280 (7.6)
Cornea	241/1280 (18.8)

Variables of interest	All Referrals
Anterior segment	47/1280 (3.7)
Lens	61/1280 (4.8)
Glaucoma	12/1280 (0.9)
Posterior Segment	249/1240 (19.5)
Optic Nerve/Motility	177/1280 (13.8)
Panocular	5/1280 (0.4)
Normal Ocular Exam	213/1280 (16.6)
Not specified	45/1280 (3.5)

EEC = Emergency Eye Clinic; HDH =Hotel Dieu Hospital, SD = Standard deviation; IQR = Interquartile range; km = kilometers

Table 2
Ophthalmic examination findings documented in referrals stratified by referring provider type

Provider type	VA documented n/N (%)	IOP documented n/N (%)	Pupil examination documented n/N (%)	AS and/or PS examination documented n/N (%)	Proposed and/or rule-out diagnosis documented n/N (%)
All referrals (n = 1280)	480/1280 (37.5)	224/1280 (17.5)	136/1280 (10.6)	362/1280 (28.3)	542/1280 (42.3)
Ophthalmology (n = 51 referrals)	15/51 (29.4)	9/51 (17.6)	0/51 (0.0)	16/51 (31.4)	21/51 (41.2)
Optometry (n = 287 referrals)	226/287 (78.7)	190/287 (66.2)	60/287 (20.9)	186/287 (64.8)	141/287 (49.1)
Emergency Medicine (n = 192 referrals)	39/192 (20.3)	10/192 (5.2)	12/192 (6.3)	33/192 (17.2)	105/192 (54.7)
Family Medicine (n = 564 referrals)	167/564 (29.6)	14/564 (2.5)	54/564 (9.6)	104/564 (18.4)	205/564 (36.3)
Medical specialities (n = 48 referrals)	0/48 (0.0)	0/48 (0.0)	0/48 (0.0)	1/48 (2.1)	24/48 (50.0)
Surgical specialities (n = 13 referrals)	1/13 (7.7)	0/13 (0.0)	0/13 (0.0)	1/13 (7.7)	3/13 (23.1)
Other medical specialities (n = 42 referrals)	3/42 (7.1)	0/42 (0.0)	0/42 (0.0)	5/42 (11.9)	23/42 (54.8)
Other professions (n = 80 referrals)	29/80 (36.3)	0/80 (0.0)	10/80 (12.5)	16/80 (20.0)	20/80 (25.0)

VA = Visual acuity; IOP = Intraocular pressure; AS = Anterior segment; PS = Posterior segment

Table 3
Variables associated with diagnostic concordance between referral diagnosis and initial EEC diagnosis

Variable	Discordant	Concordant	Test statistic	p-value
Provider Type, n/N (%)			χ^2 = 33.681	**< 0.001***
• Ophthalmology	4/21 (19.0)	17/21 (81.0)		
• Optometry	38/141 (27.0)	103/141 (73.0)		
• Emergency Medicine	38/106 (35.8)	68/106 (64.2)		
• Family Medicine	96/205 (46.8)	109/205 (53.2)		
• Other Medical/Surgical Specialties	31/50 (62.0)	19/50 (38.0)		
• Other Non-Medical Providers	13/20 (65.0)	7/20 (35.0)		
Male sex, n/N (%)	98/249 (39.4)	151/249 (60.6)	χ^2 = 0.242	0.623
Visual acuity reported, n/N (%)	75/215 (34.9)	140/215 (65.1)	χ^2 = 4.684	**0.030***
Pupil assessment reported, n/N (%)	24/63 (38.1)	39/63 (61.9)	χ^2 = 0.173	0.677
Intraocular pressure reported, n/N (%)	30/107 (28.0)	77/107 (72.0)	χ^2 = 8.610	**0.003***
Anterior and/or posterior segment examination reported, n/N (%)	56/171 (32.7)	115/171 (67.3)	χ^2 = 6.248	**0.012***
Abnormal pupil examination, n/N (%)	5/21 (23.8)	16/21 (76.2)	χ^2 = 2.842	0.092
Time from referral to assessment, days, median (IQR)	3 (1–7)	2 (1–5)	U = 29,521.5	**0.003***
Distance from HDH, km, median (IQR)	10 (10–48)	10 (10–48)	U = 31,943.0	0.701
Age, years, median (IQR)	56.5 (36.0–69.0)	62.0 (45.0–70.0)	U = 31,285.0	**0.018***
Visual acuity, OD (logMAR), median (IQR)	0.0 (0.0–0.1)	0.0 (0.0–0.1)	U = 33,559.5	0.732
Visual acuity, OS (logMAR), median (IQR)	0.0 (0.0–0.1)	0.0 (0.0–0.14)	U = 31,318.0	0.111
Intraocular pressure, OD, median (IQR)	14 (12–17)	14 (12–16)	U = 31,225.0	0.761
Intraocular pressure, OS, median (IQR)	14 (12–16)	14 (12–16)	U = 31,483.5	0.933

(*) = indicates significance; EEC = Emergency Eye Clinic; HDH =Hotel Dieu Hospital; IQR = interquartile range; OD = right eye; OS = left eye; IOP = intraocular pressure; χ^2 = Pearson chi-square statistic; U = Mann–Whitney U statistic. Categorical variables were compared using Pearson chi-square tests and continuous variables using Mann–Whitney U tests. Concordance was defined as agreement between the anatomical classification of the referring provider's proposed or rule-out diagnosis and that assigned at the initial EEC assessment.

Table 4
Variables associated with subsequent ophthalmology subspecialty referral

Variable	No subspecialty referral	Subspecialty referral	Test statistic	p-value
Provider Type, n/N (%)			$\chi^2 = 45.609$	**<0.001***
• Ophthalmology	29/51 (56.9)	22/51 (43.1)		
• Optometry	171/287 (59.6)	116/287 (40.4)		
• Emergency Medicine	160/192 (83.3)	32/192 (16.7)		
• Family Medicine	427/564 (75.7)	137/564 (24.3)		
• Other Medical/Surgical Specialties	78/103 (75.7)	25/103 (24.3)		
• Other Non-Medical Providers	61/80 (76.3)	19/80 (23.8)		
Male sex, n/N (%)	402/580 (69.3)	178/580 (30.7)	$\chi^2 = 5.665$	**0.017***
Visual acuity reported, yes, n/N (%)	332/480 (69.2)	148/480 (30.8)	$\chi^2 = 4.280$	**0.039***
Pupil assessment reported, yes, n/N (%)	105/136 (77.2)	31/136 (22.8)	$\chi^2 = 1.690$	0.194
Intraocular pressure reported, yes, n/N (%)	137/224 (61.2)	87/224 (38.8)	$\chi^2 = 17.510$	**< 0.001***
Anterior and/or posterior segment examination reported, yes, n/N (%)	239/362 (66.0)	123/362 (34.0)	$\chi^2 = 10.624$	**0.001***
Rule-out diagnosis reported, yes, n/N (%)	401/542 (74.0)	141/542 (26.0)	$\chi^2 = 1.040$	0.308
Abnormal pupil examination, yes, n/N (%)	39/70 (55.7)	31/70 (44.3)	$\chi^2 = 12.056$	**< 0.001***
Time from referral to assessment, days, median (IQR)	3 (1–8)	4 (1–10)	U = 141,752.0	**0.004***
Distance from HDH, km, median (IQR)	10 (10–48)	10 (10–48)	U = 145,638.0	1.000
Age, years, median (IQR)	57.0 (37.0–68.0)	64.0 (47.0–73.8)	U = 134,611.5	**< 0.001***
Visual acuity, OD (logMAR), median (IQR)	0.0 (0.0–0.1)	0.1 (0.0–0.3)	U = 109,007.5	**< 0.001***
Visual acuity, OS (logMAR), median (IQR)	0.0 (0.0–0.1)	0.1 (0.0–0.3)	U = 113,755.5	**< 0.001***

Variable	No subspecialty referral	Subspecialty referral	Test statistic	p-value
Intraocular pressure, OD, median (IQR)	14 (12–16)	14 (12–17)	U = 146,691.0	0.855
Intraocular pressure, OS, median (IQR)	14 (12–16)	14 (12–17)	U = 143,986.0	0.620

(*) = indicates significance; EEC = Emergency Eye Clinic; HDH = Hotel Dieu Hospital; IQR = interquartile range; OD = right eye; OS = left eye; χ^2 = Pearson chi-square statistic; U = Mann–Whitney U statistic. Data are presented as n/N (%) for categorical variables and median (IQR) for continuous variables. Categorical variables were compared using Pearson chi-square tests and continuous variables using Mann–Whitney U tests. Subspecialty referral was recorded only when initiated after the initial EEC assessment and documented in the medical record.

Figure 1. Percentage of concordant (dotted) and discordant (solid black) diagnoses by anatomical category assigned from referral information, compared with the initial Emergency Eye Clinic assessment. (L/L/A = lids/lacrimal/adnexa, Conj. = conjunctiva, AS = anterior segment, PS = posterior segment)

Declarations

Datasat availability

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Conflicts of interest:

The authors declare no potential conflicts of interest.

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Author Contribution

KAH, SB, MB, SC, and WH contributed to the conception of the work. LB, MS, NS, AP, and KAH contributed to data acquisition. WH and KAH performed the data analysis. All authors contributed to

drafting and revising the manuscript and approved the final version for publication.

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Figures

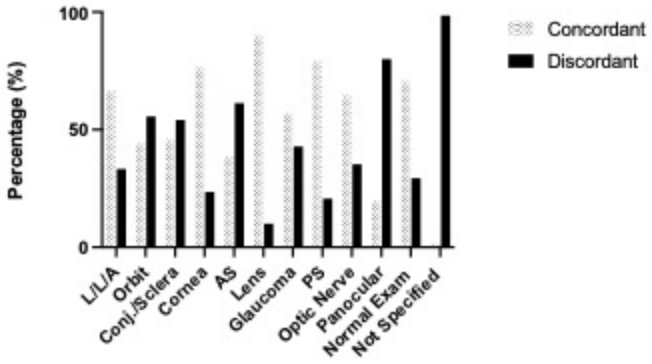


Figure 1

Percentage of concordant (dotted) and discordant (solid black) diagnoses by anatomical category assigned from referral information, compared with the initial Emergency Eye Clinic assessment. (L/L/A = lids/lacrimal/adnexa, Conj. = conjunctiva, AS = anterior segment, PS = posterior segment)