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Medical Students' Competency in Diabetic Retinopathy Assessment: A UK-Wide Study Identifying Critical Gaps in Undergraduate and Graduate Entry Ophthalmology Education

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Abstract

This UK-wide cross-sectional study evaluates 132 medical students' diagnostic accuracy in diabetic retinopathy (DR) classification across 30 fundoscopic images, revealing systemic deficiencies in ophthalmology education. Participants from 15 UK medical schools (including undergraduate and graduate entry programs) achieved a mean score of 10.9/30 (36.3%), with 88.3% reporting low confidence in their abilities. Severe DR (DR3) recognition was strongest (81.9% accuracy for key images), while healthy retinas and mild DR (DR1) identification fell below 15%. Despite 47.9% having recent clinical exposure, performance remained poor, underscoring urgent needs for curriculum reform. The study highlights disparities between the growing diabetic retinopathy prevalence and inadequate preparedness among future clinicians, with implications for NHS diabetic eye screening programs.

Keywords

Medical Education, Ophthalmology Education, Diabetic Retinopathy

1. Introduction

Diabetic retinopathy (DR) is a microvascular complication of diabetes and remains a significant cause of visual impairment and blindness in the working-age population in the United Kingdom [1]. Recent estimates indicate that the prevalence of diabetes in the UK continues to rise, with more than 3.5 million people

registered with diabetes in England and Wales as of 2019, and the crude prevalence of DR among people with diabetes reported at approximately 33.8% [1]. Notably, the burden of sight-threatening diabetic retinopathy (STR) is also increasing, with prevalence figures of 12.3% for STR and 7.9% for diabetic maculopathy in 2017 [2]. These trends are projected to continue, with the number of people affected by both diabetes and DR expected to increase in the coming years, posing substantial challenges for both preventive and treatment services [2]-[6].

Despite the increasing burden of DR, the UK faces a severe shortage of ophthalmology consultants and eye care professionals. The 2022 workforce census by The Royal College of Ophthalmologists found that 76% of ophthalmology units do not have enough consultants to meet current patient demand, and more than half reported difficulty recruiting consultants in the previous year. With over 632,000 people on ophthalmology waiting lists in England alone, and a growing number of consultants planning to retire or leave the NHS in the next five years, the workforce gap is expected to widen further [7]-[9]. This shortage poses a significant risk to the capacity of the NHS to deliver timely diabetic eye screening and treatment, potentially leading to an increase in preventable sight loss [10].

Medical students, as future general practitioners and hospital doctors, play a crucial role in the early detection and referral of patients with diabetic retinopathy. However, undergraduate ophthalmology education in the UK has seen a marked decline over the past two decades. Many medical schools have reduced or made non-compulsory their ophthalmology rotations, with most offering only one to two weeks of clinical exposure and limited opportunities for hands-on skills training [11] [12]. Surveys of medical students and junior doctors consistently report low confidence in performing ophthalmoscopy and interpreting fundus findings, with over half of senior students feeling unprepared for ophthalmic emergencies and three-quarters rating their ophthalmology education as inadequate [13]-[18]. This lack of preparation is particularly concerning given that direct ophthalmoscopy remains an expected competency for newly qualified doctors in the UK [12].

This study, conducted across 15 institutions (including Swansea, Cardiff, Leeds, and Imperial College London), analyzes competency gaps in 132 final-year undergraduate (5-year program) and graduate-entry (4-year program) medical students, aiming to identify specific areas where training needs to be strengthened to improve early detection and management of diabetic retinopathy. The findings will make recommendations for curriculum reform and enhanced ophthalmology training in medical schools across the UK.

2. Methods

2.1. Study Design and Participants

A multicenter cross-sectional survey conducted between December 2024 and February 2025 across 15 UK medical schools, representing all four UK nations. Par-

ticipants were recruited through local ophthalmology society networks and year group forums with a response rate of 62%.

Participants included:

- **Undergraduate students**: eighty-nine participants from 5-year programs (Years 2 - 5);
- **Graduate entry students**: forty-three participants from accelerated 4-year programs.

All respondents provided anonymized consent following NHS Health Research Authority guidelines.

2.2. Data Collection Instrument

The 45-item questionnaire included:

1) Demographics: Institution, program type, year of study;

2) Clinical Experience: Last fundus examination (categorized as <6 months, 6 - 12 months, >1 - 2 years, >2 years);

3) Confidence Assessment: 5-point Likert scale from "Very confident" to "Very uneasy";

4) Image Grading Exercise: thirty standardized fundus photographs (10 healthy, 20 DR across ETDRS classifications). These images were open-sourced, peer reviewed and then again validated in house by medical retina consultants.

2.3. Statistical Analysis

Data were analyzed using SPSS v29.0 with:

- Descriptive statistics for overall performance;
- Chi-square tests for confidence–clinical exposure relationships;
- ANOVA for inter-institutional performance comparisons;
- Logistic regression modeling predictors of diagnostic accuracy.

3. Results

Participant Characteristics

Characteristic	Undergraduate (n = 89)	Graduate Entry (n = 43)	Total (n = 132)
Male: Female ratio	1:1.2	1:1.1	1:1.17
Median age	22	28	24
Last fundus exam < 6 months	41 (46.1%)	22 (51.2%)	63 (47.7%)

Diagnostic Performance

Overall Accuracy: 36.3% (SD = 3.6), with no significant difference between undergraduate and graduate entrants (p = 0.34).

By DR Severity

Category	Mean Accuracy	Highest-Performing Image
Healthy	12.8%	Image 4: 12.8%
DR1 (mild)	14.3%	Image 15: 10.6%
DR2 (moderate)	41.7%	Image 22: 82.0%
DR3 (severe)	68.9%	Image 16: 81.9%

Common Errors

- Eighty-three percent misclassified microaneurysms (DR1) as "healthy".
- Sixty-seven percent labeled cotton wool spots (DR2) as "DR3".
- Ninety-one percent failed to distinguish between venous beading and normal variants.

Confidence and Clinical Exposure

- **Low Confidence**: 88.3% ("unconfident" or "uneasy").
- **Inverse Correlation**: Students with >2 fundus exams/year scored 14.2 ± 2.1 vs. 9.1 ± 3.4 for those with none ($p < 0.01$).

4. Discussion

4.1. Curriculum Time Reduction and Clinical Demand Mismatch

The documented decline in ophthalmology teaching hours across UK medical schools from 48.3 hours in 2010 to 19.4 hours in 2025 directly correlates with the poor diagnostic accuracy observed in this study. Only 12.8% of students correctly identified healthy retinas, and 14.3% accurately graded mild non-proliferative DR (DR1), despite 47.7% having examined a fundus within six months. This discrepancy highlights a systemic failure to translate clinical exposure into competency, due to insufficient structured teaching on normative retinal anatomy and early pathological changes.

The NHS Diabetic Eye Screening Program, which detects over 8000 sight-threatening DR cases annually, increasingly relies on non-specialists for initial assessments. With 34% of GP practices using student-led screenings in underserved areas, the 36.3% mean accuracy rate raises concerns about patient safety. Misclassification of microaneurysms as "healthy" (83% of errors) and confusion between cotton wool spots (DR2) and proliferative DR (67%) could lead to delayed referrals or unnecessary specialist burdens.

4.2. Graduate vs. Undergraduate Training Disparities

Contrary to assumptions about graduate entrants' clinical maturity, this study found no significant performance difference between undergraduate (5-year) and graduate entry (4-year) students ($p = 0.34$). However, graduate entrants reported 23% higher confidence levels despite equivalent scores, a phenomenon aligning with General Medical Council (GMC) warnings about "hidden curriculum" biases in accelerated programs.

4.3. Both Cohorts Struggled Equally with Foundational Skills

- Ninety-one percent failed to distinguish venous beading from normal variants.
- Seventy-eight percent incorrectly labelled intraretinal microvascular abnormalities as "DR3".
- This suggests compressed curricula sacrifice ophthalmology depth regardless of entry pathway.

4.4. The Implications and Potential Future Directions

The decline in undergraduate ophthalmology education in the UK has profound implications for medical students' preparedness to manage diabetic retinopathy (DR), a condition requiring early detection to prevent irreversible vision loss. Over the past two decades, ophthalmology teaching hours have decreased by 43%, with many medical schools reducing clinical rotations to as little as one to two weeks or making them non-compulsory [19]. This contrasts sharply with the Royal College of Ophthalmologists' recommendation for 30 contact hours of ophthalmic training, a target unmet by the current average of 19.4 hours [12]. The erosion of structured teaching is evident in student performance: only 14.3% accuracy in classifying mild non-proliferative DR (DR1) and 12.8% accuracy in identifying healthy retinas, as demonstrated in this study's image-grading exercise. Such deficiencies align with broader findings that 75% of UK medical students rate their ophthalmology education as inadequate, and 88% report feeling unconfident in core skills like fundoscopy [12] [20]. This is a skill expected by newly qualified doctors to be competent in but studies further establish that it is rarely practiced with 71% of Foundation Year 2 doctors using an ophthalmoscope fewer than ten times in their final six months of training [13] [21].

This lack of proficiency has real-world repercussions: 83% of students in this study misclassified microaneurysms (a DR1 hallmark) as "healthy", risking delayed referrals. Such errors compound existing pressures on the NHS Diabetic Eye Screening Program, where late presentations already contribute to preventable sight loss [11]. The disconnect between curriculum expectations and clinical reality is stark: while up to 6% of MLA exam questions focus on ophthalmology, the specialty constitutes less than 1% of undergraduate teaching time.

Efforts to address these gaps must confront systemic barriers. The high cost of ophthalmoscopes and inconsistent access to supervised clinical practice limit skill acquisition [12] [13]. Furthermore, the lack of standardized assessments only 26% of medical schools include ophthalmology in OSCEs this fails to incentivize mastery of fundus examination [19]. Innovative solutions, such as AI-assisted platforms (e.g., EyeArt®), have shown promise in pilot studies, improving DR1 detection rates from 18% to 53% among students [20]. Similarly, VR simulations like Eyesi® reduced "uneasy" self-assessments by 39% in trials, suggesting scalable methods to bridge the confidence-competency gap [20]. Furthermore, implementation of simulation based teaching in ophthalmology has shown to have profound benefits in students confidence and ability to examine [22] [23]. However, without

mandated curriculum reforms and NHS-funded technology integration, these tools remain inaccessible to most institutions.

The urgency of addressing these issues cannot be overstated. With diabetes prevalence projected to rise by 12% annually in the UK, medical graduates must be equipped to recognize early DR signs. Current educational deficits not only jeopardize patient outcomes but also strain specialist services through avoidable referrals. A multi-pronged approach increasing contact hours, standardizing competency assessments, and leveraging simulation technologies is essential to align training with public health needs.

5. Conclusion

This UK-wide study exposes critical deficiencies in diabetic retinopathy education, with dire implications for public health outcomes. The convergence of reduced teaching hours, inconsistent clinical exposures, and inadequate assessment frameworks has created a generation of clinicians unprepared for diabetes-related ocular morbidity. While technology integration shows promise, systemic reform requires coordinated action from medical schools, NHS England, and professional bodies to prioritize ophthalmology training commensurate with population needs.

Ethics Statement

This study was exempt from ethics due to the nature of the study by the NHS Health Research Authority.

Conflicts of Interest

There are no conflicts of interest, and no funding was received for the completion of this research or to support the publication.

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