Technoleg Iechyd Cymru
Health Technology Wales

Topic Exploration Report [1]

Digital External Eye Imaging

What is a Topic Exploration Report?

Topic Exploration Reports are not health technology assessments. These reports provide a high-level briefing on new topics submitted to Health Technology Wales and are not based on exhaustive or systematic literature searches. Instead, they rely on a focussed scan of key resources.

What evidence is used in a Topic Exploration Report?

Priority is given to summarising the most relevant or useful evidence, rather than covering all possible evidence. Information reported is typically based on abstracts and study authors' own conclusions, rather than detailed scrutiny of full texts.

What are the aims of a Topic Exploration Report?

Topic Exploration Reports offer an overview of the available evidence on a topic and aim to highlight any uncertainties or gaps in the evidence. These reports outline the quantity and type of evidence found, but no critical appraisal or formal evidence synthesis is conducted.

How should a Topic Exploration Report be used?

Topic Exploration Reports can be used to indicate what evidence may be available for a topic, and do not provide definitive guidance on how a technology should be used. The evidence presented within the reports should be interpreted with caution.

[1] Cyfieithu dogfennau HTW wedi'u cyhoeddi o'r Saesneg i'r Gymraeg
Translation of published technical HTW documents from English into Welsh

Topic exploration report number	TER678
Topic	Digital External Eye Imaging
Summary of findings	The current pathway for diagnosis of external eye disease is for community optometry services to submit referrals with a written clinical history to secondary care ophthalmology services for face-to-face diagnosis and management. The set-up of an image-based teleophthalmology care pathway where digital photographic images are attached to written referrals (image based referrals), may reduce time to decision, time to treatment, number of repeated-triage visits, number of outpatient appointments and waiting times. We identified one broad systematic review that examined interventions aiming to reduce the number of false-positive referrals seen in face-to-face hospital eye services. There was some evidence that teleophthalmology reduced false-positive referrals, but it was not clear how many of the studies were in participants with external eye conditions or how many included digital external eye images with the referral. Four additional single arm studies reported on service evaluations or feasibility of image-based teleophthalmology care pathways. In these studies, between 31% to 58% of patients required a face-to-face hospital appointment or treatment. In two studies between 23% to 33% of patients were discharged with advice after photographs were taken. The studies concluded that use of teleophthalmology safely reduced non-essential face-to-face visits. An additional primary study conducted in a secondary care lid oncology service reported evidence that, compared to imaging using digital slit lamps, using a smartphone with lens attachment was time-saving and images were of high enough quality to make clinical decisions. We also identified a scoping review and one primary study examining diagnostic accuracy of teleophthalmology imaging devices for external eye disease. Diagnostic accuracy was reported to vary greatly from condition to condition and from device to device. We did not identify any economic evaluations.

Introduction and aims

External eye disease includes a range of conditions including lesions which may be benign but need treatment, suspected malignant lesions, eyelid cysts, conjunctival lesions, pterygia and conditions requiring longer-term monitoring. External eye diseases are externally visible at the front (anterior) section of the eye and do not require any special equipment apart from a good light source and a simple magnifying lens to be seen by the examiner. External eye disease should be assessed and diagnosed in a timely manner to avoid significant adverse outcomes. At present there is a national capacity problem in Wales for ophthalmology. At the end of May 2026, 155,788 ophthalmology patients were waiting for an outpatient appointment, with around half waiting for longer than their clinically determined target date. The topic proposer told HTW that ophthalmology is the highest-volume outpatient specialty in the NHS and demand is projected to rise substantially over the coming two decades, so pathways that avoid unnecessary hospital attendances are a national priority.

Current standard of care for external eye disease is for community optometry services to submit referrals, primarily a written clinical history, to secondary care ophthalmology services for face-to-face diagnosis and management. However, written referrals may lack sufficient detail to allow for accurate triage which can result in delays, repeat assessments and additional outpatient appointments. In several cases, after a written referral is received, it is triaged to photography. These patients must then attend an initial hospital photography appointment, which the clinician then reviews, before a definitive decision (clinical advice, face-face appointment or list for surgery) can be reached.

Many external eye diseases can be assessed and diagnosed using high-quality photographs. Digital clinical, or slit-lamp, photographic images, captured during the patient's community optometry examination, could be attached to referrals for later remote review, diagnosis and triage by a consultant ophthalmologist or other expert. The pathway would operate across an integrated primary- and secondary-care eye service. People would attend a community optometry practice, working under the Welsh General Ophthalmic Services, and undergo a clinical examination where an agreed minimum clinical dataset and standardised imaging using suitable clinical equipment would be collected. There are a number of different methods for capturing images which include digital slit-lamp systems, smartphone-to-slit-lamp imaging adapters or clip-on phone lens adapters. Images would be transferred to secondary care using the pre-existing electronic referral eyecare service, OPERAi, and stored in pre-existing electronic record systems.

The set-up of an image-based teleophthalmology care pathway may reduce time to decision, time to treatment, number of repeated-triage visits, number of outpatient appointments and waiting times. In addition, use of digital images may reduce inequalities by improving access for people who have difficulty attending hospital outpatient appointments by enabling remote assessment. Photographs would be taken at a local community optometry clinic or at a patient's home by a mobile optometry clinic service, by the optometrist so people would not need access to a smartphone and would not need to upload images themselves.

Health Technology Wales researchers searched for evidence on the clinical and cost-effectiveness of digital external eye photography images to accompany patient referrals to secondary care, compared to standard referral practices.

Evidence overview

We did not identify any relevant health technology assessments. We identified one relevant mixed-methods systematic review (Carmichael et al. 2023), one scoping review (Cao et al. 2023) and six additional relevant primary studies that were not included in the reviews (Ah-

Evidence overview

Kye et al. 2023, Busquet-Duran et al. 2022, Gillam et al. 2023, Kang et al. 2021, Kilduff et al. 2023, Patel et al. 2026).

Secondary evidence

Carmichael et al. (2023) conducted a broad, mixed-methods narrative synthesis of studies that aimed to reduce the number of false-positive referrals seen in face-to-face hospital eye services. Literature published between December 2001 to December 2022 was searched for any qualitative, quantitative or mixed-methods study that involved primary care optometrists making referrals to secondary care for any eye condition. Fifty-five studies were included, of which 13 evaluated asynchronous teleophthalmology. The review reported that there was evidence that asynchronous teleophthalmology reduced false-positive referrals, although moderate levels of false-negative cases, where patients who were discharged but subsequently needed a hospital referral, were observed. It is not clear from the abstract how many of the studies were in participants with external eye conditions or how many included digital external eye images with the referral.

Cao et al. (2023) conducted a scoping review of literature relating to teleophthalmology imaging devices for cornea and external segment conditions. The review identified 51 devices, of which 19 were slit-lamp based, 17 were smartphone-based and 15 were other devices. Devices were designed to detect a wide range of cornea and external eye diseases. Diagnostic accuracy was assessed for 24 of the 51 devices. The review reported that diagnostic accuracy varied greatly from condition to condition and from device to device and that further studies were needed to validate use of the devices in teleophthalmology.

Primary evidence

Patel et al. (2026) examined the feasibility of teleophthalmology for corneal disease in vision centres in rural and semi-urban North India in a prospective observational study. At the vision clinic images of the anterior section of the eye were taken by a vision technician using a smartphone. For patients where corneal pathology was suspected, additional fluorescein-stained images were taken under cobalt blue light. Images were sent via a web-based application for review by an in-training cornea fellow in tertiary care. 4,825 patients with corneal disease were identified, 42% were managed at the vision centres and 58% were referred for face-to-face appointments in secondary care. The authors concluded that teleconsultation that included images reduced unnecessary referrals and enabled management of corneal diseases in primary care.

Gillam et al. (2023) conducted a service evaluation reporting on first-year safety and efficacy of a technician led image-based eyelid lesion management service run by NHS Greater Glasgow and Clyde. Data were retrospectively collected from 808 patients referred to eyelid photography clinics from September 2020 to September 2021. The service evaluation reported that there was a decrease in mean time from referral to appointment between the first four months and last four months of the service (93 days to 11 days, $p<0.001$). Overall, 33% of patients were discharged with advice after photographs and 46% were offered an eyelid procedure. Malignant lesions were identified and confirmed by biopsy for 13 patients, of whom only three had been referred for suspected malignancy. 7% of patients with at least six months follow-up were re-referred after treatment or discharge, all with non-malignant conditions.

Ah-Kye et al. (2023) conducted a similar retrospective service evaluation of 974 patients examining effectiveness in an image-based tele-oculoplastic service for patients referred for benign eyelid lesions. The study was conducted in the US. Overall, 23% were discharged after photographs, 57% were offered an eyelid surgical procedure, 11% received a further video-consultation and 7% required a face-to-face appointment. The study reported efficient referral-

Evidence overview

to-treatment times, waiting times, and consultation times and a non-attendance rate of 3%. No missed diagnoses of malignancy were reported.

Busquet-Duran et al. (2022) reported on a retrospective analysis of an asynchronous telemedicine clinic in Spain for eyelid diseases. Telemedicine consultations included the attachment photographs to electronic patient records for review by a specialist at a tertiary centre. The photographs were taken by primary care staff, including optometrists or outpatient ophthalmologists, using a mobile phone or tablet. Data from patients who attended the clinic between 2013 and 2019 were included. It was reported that unnecessary referrals were avoided in 72% of consultations. More detailed analysis was conducted in 2018 to 2019 where 31% of consultations required face-to-face hospital referrals. 68% of the referrals were due to eyelid tumours, 50% needed surgery and 18% a biopsy. 10% of the eyelid tumours were malignant. There was high reliability between telemedicine diagnoses and those made face-to-face.

Kang et al. (2021) conducted a study in the UK in 44 people with eyelid lesions to examine the agreement between image-based remote diagnosis and management compared to face-to-face. Participants were seen by a nurse specialist in a face-to-face clinic who collected information using a proforma and devised a diagnosis and action plan. Photographs of the eyelid were taken by a medical photographer. The proforma and photographs were also reviewed remotely by an oculoplastic consultant. The study reported 91% agreement in diagnosis between the nurse specialist and the remote review (kappa=0.88) and 82% agreement in the management plans. The average time taken for the remote reviewer per participant was 1 minute and 20 seconds.

Kilduff et al. (2023) conducted an evaluation of a 'Bring Your Own Device' photography service in a lid oncology clinic in London. Healthcare Assistants took external eye photographs using a smartphone, owned by the staff, with a lens attachment. If lesions were judged to require slit lamp imaging, these were conducted by a doctor. Images were uploaded to patient records twice a week. The study reported that, compared to slit lamp imaging, use of a smartphone saved patients 41 minutes (which was a third of the total appointment time), reduced delays to treatment to zero. 97.5% of smartphone images were of high enough quality for clinical decision making. Management plans made using the smartphone images were consistent with those made in face-to-face appointments for 92.5% of images.

Areas of uncertainty

- Limited comparative evidence on the use of digital external eye photography images. The comparative evidence appears to concentrate on concordance in diagnosis and management between image-based referrals compared with face-to-face appointments alone rather than in comparison with written referrals +face-to-face appointments
- The impact of using image-based referrals compared with written referrals +face to face consultations on time to decision, time to treatment, number of repeated-triage visits, and waiting times.
- Whether there are appropriate clinical outcomes that should be examined.
- Cost-effectiveness.
- Whether effectiveness differs between conditions and/or the methods of capturing digital external eye images (e.g. digital slit-lamp systems, smartphone-to-slit-lamp imaging adapters or clip-on phone lens adapters).

Areas of uncertainty
• Whether mandating an a priori, device-agnostic minimum image-quality standard, as opposed to unstandardised capture, improves the effectiveness of image-based triage and referral, and whether it does so consistently across conditions and capture devices.

Literature search results

Health technology assessments and guidance
No evidence identified
Evidence reviews and economic evaluations
Cao B, Vu CHV, Keenan JD. (2023). Telemedicine for Cornea and External Disease: A Scoping Review of Imaging Devices. Ophthalmology and Therapy. 12(5): 2281-93. doi: https://doi.org/10.1007/s40123-023-00764-3 Carmichael J, Abdi S, Balaskas K, et al. (2023). The effectiveness of interventions for optometric referrals into the hospital eye service: A review. Ophthalmic and Physiological Optics. 43(6): 1510-23. doi: https://doi.org/10.1111/opo.13219
Individual studies
Ah-Kye L, Butt A, Gupta A, et al. (2023). Introducing the 'Benign Eyelid Lesion Pathway': 1 year experience of synchronous tele-oculoplastics in a tertiary hospital. Eye. 37(7): 1458-63. doi: 10.1038/s41433-022-02166-4 Busquet-Duran N, Vidal-Alaball J, Martinez-Somolinos S, et al. (2022). Descriptive study of a telemedicine program in palpebral pathology for primary care (tele-eyelid). Archivos De La Sociedad Espanola De Oftalmologia. 97(6): 303-9. doi: https://dx.doi.org/10.1016/j.oftale.2022.03.005 Cao B, Vu CHV, Keenan JD. (2023). Telemedicine for Cornea and External Disease: A Scoping Review of Imaging Devices. Ophthalmology and Therapy. 12(5): 2281-93. doi: https://doi.org/10.1007/s40123-023-00764-3 Carmichael J, Abdi S, Balaskas K, et al. (2023). The effectiveness of interventions for optometric referrals into the hospital eye service: A review. Ophthalmic and Physiological Optics. 43(6): 1510-23. doi: https://doi.org/10.1111/opo.13219 Gillam M, Younus O, Loo S, et al. (2023). Is an image-based eyelid management service safe and effective? Eye. 37: 3643-7. doi: 10.1038/s41433-023-02572-2 Kang S, Dehabadi M, Sim DA, et al. (2021). Accuracy of periocular lesion assessment using telemedicine. BMJ Health & Care Informatics. 28(1): e100287. doi: 10.1136/bmjhci-2020-100287 Kilduff CLS, Deshmukh M, Guevara G, et al. (2023). Creating a secure clinical 'Bring Your Own Device' BYOD photography service to document and monitor suspicious lesions in the lid oncology clinic. Eye (Lond). 37(4): 744-50. doi: https://doi.org/10.1038/s41433-022-02049-8 Patel NV, Kataria M, Aggarwal M, et al. (2026). Teleophthalmology for triage and management of corneal pathologies at vision centres: a prospective observational service evaluation study in north India. Frontiers in Ophthalmology. Volume 6 - 2026. doi: 10.3389/fopht.2026.1867442
Ongoing research
None identified

Date of search	July 2026
Concepts used	Digital external eye photography; external photographs of the eye; digital slit-lamp photography; smartphone-to-slit-lamp imaging adapter; clip-on phone lens adapter; periocular lesion

Proposed research question and evidence selection criteria (if selected)

Proposed Research question	**What is the clinical and cost-effectiveness of digital external eye photography images to accompany patient referrals to secondary care, compared to standard referral practices?**

	Inclusion criteria	Exclusion criteria
Population	Adults and children with suspected external eye disease	
Intervention	Referral to secondary care with attached digital external eye photography images (image-based teleophthalmology)	
Comparison/ Comparators	Standard referral without attached digital external eye photography images Face-to-face secondary care ophthalmology appointments.	
Outcome measures	Time to decision Time to treatment Number of repeated-triage visits Number of outpatient appointment Waiting times Patient satisfaction Health related QoL Resource use Economic outcomes	

Proposed specialities	**Eye; Health service organisation and delivery**