Identifying blind glaucoma patients with a semi-automated algorithm: A cross-sectional survey revealing missed certification of visual impairment

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Background

- Blind (severely sight impaired) patients are eligible for social benefits but these require ophthalmologist referral for a certificate of visual impairment (CVI).
- Glaucoma is the most frequent cause of irreversible blindness worldwide and in the UK, causing lots of these patients to require certification.
- Certification criteria are ambiguous and subjective, and ophthalmologists frequently disagree about eligibility.
- Variability in judgement combined with reliance on ophthalmologist referral leads to inequity in the provision of care in the community.

Methods

- A retrospective cross-sectional study was undertaken of all glaucoma patients attending a tertiary referral clinic over 12 months.
- A semi-automated algorithm using visual acuity and perimetry data was used to identify CVI-eligible patients (Figure 1).
- A computed vision application (GFDC) was developed to classify perimetry plots using Hodapp-Parrish-Anderson criteria.
- CVI-eligible patients were cross checked against the ECLO register to quantify the rate of missed registration.
- Missed patients were scrutinised to explore potential reasons for lack of certification.
- Analysis and data visualisation were undertaken in R.

Results

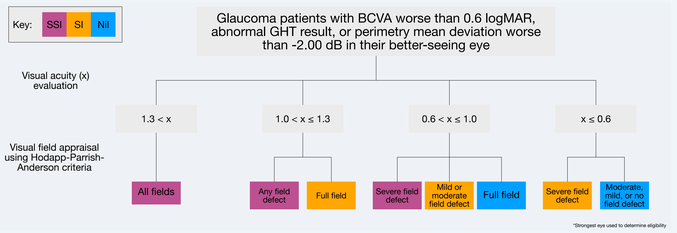


***Figure 1** | The semi-automated algorithm used to screen patients.*

- Of 5,620 individual patients screened with the semi-automated algorithm (Figure 2), 919 were classified as sight impaired, and 64 were classified as severely sight impaired (blind).
- Of the blind glaucoma patients, 7 (11%) were misclassified due to having a better-seeing eye that had not been tested (Figure 3; 'extenuating circumstances').
- 21 of 57 eligible glaucoma patients (37%) were unregistered for a CVI.
- Reasons for missed registration (Figure 3) included administrative failure (24%), lack of consent (10%), reversible visual impairment (19%), frailty and co-morbidity (71%), and mental health diagnoses (38%).

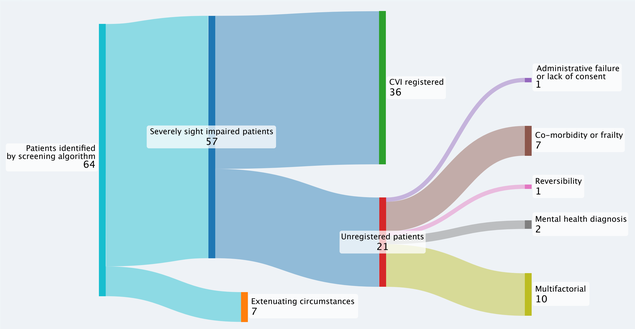


***Figure 3** | Sankey diagram depicting the risk factors for severe sight impairment without CVI-registration. Multifactorial missed certification is common, and the most common risk factors are frailty and co-morbidity.*

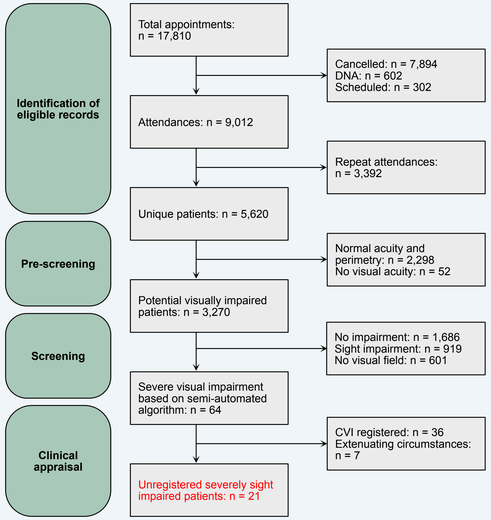


***Figure 2** | Patient flow chart depicting how the cross-sectional study was undertaken. Initial administrative screening was undertaken to identify the number of individual patients that attended glaucoma clinics over a 12-month period. Pre-screening was undertaken using strict perimetry and visual acuity criteria applied to the better-seeing eye. Subsequent screening was undertaken using best corrected visual acuity and Hodapp-Parrish-Anderson classification (facilitated by GFDC) to categorise patients as sight impaired or severely sight impaired (blind). Blind patients were investigated further to verify CVI-registration and explore specific reasons for missed registration.*

Conclusions

- Many blind glaucoma patients are not CVI-registered, implying under-provision of support in the community.
- Reasons for missed registration may include co-morbidity (especially frailty and mental health diagnoses), administrative failure, and the inherent subjectivity of referral criteria.
- An objective algorithm using visual acuity and perimetry parameters can identify blind glaucoma patients without generating false positive results.
- Automated screening could prompt ophthalmologists to consider CVI-referral or act as an additional referral mechanism.
- Improving the provision of certification could reduce the observed inequity in social support received by eligible glaucoma patients.
- Potential research applications include cohort identification for clinical trial recruitment and observational research.
- The Glaucoma Field Defect Analyser is free to use for interested clinicians and researchers (details below).

Web Application Details

The code is freely available for clinicians and researchers to use at larger scale (via https://gfdc.app); and Arun Thirunavukarasu (ajt205@cantab.ac.uk) is happy to advise on set-up and troubleshooting.

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