Scottish Government Health Directorates Chief Scientist Office

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FOCUS ON RESEARCH

Optimising diabetic retinopathy risk prediction and screening

Researchers
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Aim
Diabetic retinopathy (DR) is a diabetes complication of the eye that can be prevented by early diagnosis and treatment. The Diabetic Retinopathy Screening Programme currently screens all T1D and T2D patients aged 12 and over in Scotland at one of two intervals depending on whether they have previously been graded to having no/mild or moderate retinopathy. The aim of our study was to investigate whether risk prediction of transitioning to referable DR can be improved by including clinical covariates and to understand if this prediction can be used to derive personalised screening schedules.

Project Outline/Methodology
Data from 2007-2016 from the Diabetic Retinopathy Screening (DRS) programme was linked to clinical covariate data in the SCI-diabetes dataset. Using a training/test split of 70%/30% we modelled risks of transition to referable DR from the second screening episode for each individual using a generalised linear model with cloglog link function. Using the best performing model (based on AUROC), we set an acceptable transition risk threshold and developed two screening schedules: an optimal screening interval for each patient and an averaged optimal screening interval per prior-DR stratum (no, mild and moderate retinopathy).

Key Results
We found that model performance was improved when incorporating clinical covarites in the model for incident refereable disease. Maintaining the current yield of the screening programme, the number of screenings could be reduced when adopting the model-based screening schedules.
Adopting personalised screening intervals would reduce the overall number of screenings by 31.5%/22.4% (T1D/T2D) of the current system with a wide range of intervals in each stratum, to give the same overall and stratum specific yield of referable DR by type of DM.
Using average optimal interval for each stratum the overall number of screenings would be reduced by 34.2/18.5% (T1D/T2D) of the current system. The interval for those with no prior retinopathy would be much longer than the current 1 year (46 months for T1D/32 months for T2D). For patients with mild retinopathy the interval would stay the same for T1D (12m) but would be shortened (6m) for T2D. Intervals would be shortened for patients with moderate retinopathy (4m/1m).

Conclusions
Our study shows that including clinical covariates in addition to a patient's previous grades significantly improves prediction of referable eye disease and this could be used to better inform retinopathy screening intervals.

What does this study add to the field?
This study adds to the field that clinical data can be used to improve prediction of incidence referable DR, and also that these predictions can be used to meaningfully inform screening policy and thereby reduce the number of screenings required while maintaining the current yield of the programme.

Implications for Practice or Policy
The findings of this study have direct implications for DR screening policy. It shows that under the currently implemented system, patients with no prior retinopathy are screened more often than needed while patients with mild and moderate retinopathy have a higher risk of transitioning. Should the screening schedules derived from evidence in this study be implemented, patients risk of transition would be equal across prior-DR strata (for the average optimal interval) or across individual patients (for the individualised intervals). Additionally the number of screenings would be reduced compared to the current system, while maintaining the current yield.

Where to next?
We will continute to re-evaluate retinopathy transition rates to assess impact on policy.

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