**SpeedwEyes: an eye-screening management system in diabetic care**

Dr Stephen Corcoran, a GP with a part-time clinical attachment at the North Middlesex Hospital, and mathematics student Benjamin Graham describe their development of this useful data-management system.

**Diabetes management**

![Dr Stephen Corcoran](image1.png)

**KEYWORDS:** DIABETIC RETINOPATHY SCREENING, SYSTEM DESIGN, RECORDS MANAGEMENT.

**ABSTRACT**

We developed a relational database to store diabetic eye-screening data and minimise unnecessary labour in the production of appointments, reports and referral letters. It operates from two centres in North London and has already been used to store details of 10,000 eye examinations, each of which requires the printing of four different forms. The application has enabled us to retrieve information and audit our work. Macros and keyboard tab orders simplify data entry. Reference photographs and definitions are available during the grading process, which uses a modified Wisconsin protocol. We are planning a professional rewrite and to link the system to digital images. A working system can be developed with minimal use of code, can provide a detailed demonstration of how an organisation operates and ease the task of a professional systems developer.

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Diabetic retinopathy is the most common cause of blindness in people of working age in this country. This blindness is preventable by the timely use of laser therapy and treatment of risk factors such as high blood pressure and high blood sugar levels. Systematically examining all people with diabetes at regular intervals to identify those who would benefit from treatment is accepted as best practice and a very cost-effective public health strategy. This is because treatment is most effective when the disease is at a stage just before it noticeably affects eyesight. A good screening programme will achieve high coverage of the population at risk, identify virtually everyone with sight-threatening disease and arrange effective treatment. Specific Government funding for a national eye-screening programme is expected to be part of the National Service Framework for Diabetes.

The North Middlesex Hospital Diabetes Centre provides services to some of the most deprived and ethnically varied areas in the UK. It has been offering structured diabetic eye screening to clinic attenders since 1989. This service was extended to GP-managed patients in 1996. We needed a new user-friendly relational database to store patients' details, arrange examinations (both inhouse and with local optometrists) and to record and report findings. It would also allow rapid analysis of results and minimise clerical work.

**Development process**

From 1989, SC recorded eye examinations in a book with a page for each clinic, in addition to casenotes. When records became too numerous we decided to put them on a database. With help from our audit department we started using a Super DB database with separate tables for demographic data and each examination. We adopted a system for grading diabetic eye disease from photographs that
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was developed and validated as part of the Liverpool Diabetic Eye Study using a modified Wisconsin protocol. We converted the system of deriving grades of disease according to features seen into a form-based algorithm.

After a few years, the printouts and searching facilities seemed too basic and we wanted to incorporate the algorithm into our database, but we had no money for development. An undergraduate developed our first prototype application in Microsoft Access as a final-year project. It looked very professional with security and a manual.

It was difficult to communicate with the student during development, however, and he was unable to help after obtaining employment. For this reason it was unusable in a live situation and we lacked the knowledge to modify it.

Our practice volunteered to participate in a project analysing our preventive computer data and the coordinating doctor offered to help us. We met several times with him to define data fields and his then 15-year-old son (BG) developed a new MS Access application, which included a computerised version of the grading algorithms.

Implementation was delayed because we could not produce any forms or reports to reduce the labour involved. SC studied the database and, using the excellent manuals, slowly learned how to construct onscreen and printable forms, queries and (much later) macros while making small alterations to the existing structure. He learned how to set up a 'query by form' to display groups of episodes meeting criteria selected from multiple picklists on a single onscreen form (eg seen within a certain period, belonging to a chosen practice or not graded). When a patient arrived at the clinic we recorded his/her name, address, etc, if not already on our register, and we then opened an episode for that day where details such as nominated optometrist, current treatment and visual acuity were recorded. The pupils were dilated for retinal photography.

A key step was to enter those details directly onto the computer and then print them as a worksheet. This also showed the time and an episode number, allowing staff to call people in turn. It provided check-boxes and space for sketches, comments and photograph numbers recorded while away from the computer. When the films had been processed, this additional data was noted and the photographs were graded and filed with a report. Concurrently, letters to the patient, GP and any referral were automatically printed. Labour savings and the scope for modification made the system popular.

Around 70% of our patients belonged to an ethnic minority and some groups seem to have low attendance rates and high levels of disease. Initially for fun, we added a table with the most commonly used phrases such as "Welcome", "Open your eyes", "Look at the target" in over 30 languages. This can make people smile and feel welcome but we are now hopeful that the example will help us get funding for translation of the standard messages into key languages for appointments and reports in addition to English.

When we set up a second site it became harder to synchronise upgrades to the database. We then separated the data from the front-end database, which could be upgraded and replaced separately.

With what we had learned we were able to add:
- an appointments module with different letterheads according to the type of clinic;
- ready-to-post examination forms for nominated optometrists to use and return;
- letters to GPs if patients did not attend;
- an offsite photograph-grading module;
- reference photographs, immediately available as JPEG images for comparison;
- definitions of grading criteria, linked to the onscreen grading forms; and
- national GP and practice codes (available to NHS IT departments on CD-ROM from OCS). We are in the process of adopting NHS numbers as the main patient identifier instead of our own computer-generated IDs. We hope ultimately to be linked to our health authority, which would allow us to track patients who move or change GP. We have placed the application onto the hospital network to allow multiple users and use of the backup system.

The database allows users to:
- search for individual patients easily by name, ID or postcode;
- maintain lists of patients from each GP practice and periodically send them to the practices for updating;
- analyse results;
- use the data to inform clinical governance — to ensure that treatment is appropriate and sufficiently successful according to the severity at time of referral;
- produce individual and aggregate reports for patients, GPs and external quality control;
- operate a recall system; and
- match the postcodes to deprivation indices and compare disease severity with deprivation.

There is no computerised audit trail. We rely, therefore, on storing a printed copy of every report with the photos attached and distribution of similar reports to GPs and patients. We also make occasional permanent backups onto CD-ROM.

Observations
- Careful design of the initial data structure has proved to be a valuable foundation;
- it proved extremely useful for us to learn how to continuously modify and improve the database; and
- our work has provided a good template for a professional developer.

Results
Since we started using it, we have recorded over 10,000 screening examinations and referred over 500 people for specialist assessment and possibly treatment.

With both help and a service agreement from Barnet Health Authority, our practice used seedholding savings to set up a second screening centre based in our health centre.
The future

Our system has few defences against a user going behind the scenes and damaging data. To tidy up the structure, security and encryption, therefore, we have arranged a rewrite by a database designer.

The grading system adopted for the national service framework for the care of diabetic patients may differ from the one we have been using. To cater for this, each of the many possible retinal features has a data field, and photographs and direct clinical examination findings have separate fields. We have avoided aggregating these findings into single fields; instead, we have used macros to avoid the need to enter lots of negative findings. If the rules about what constitutes a particular level of disease change, we can generally enter a different formula to produce the new grading result from the data.

We hope that by maintaining logical table structures, using national codes and accredited standards, the data will remain valid even if the original developer suddenly leaves or dies. We would hope that with continuous development our system will be fully

we have a system that meets our needs, with sufficient flexibility to adjust to likely NSF standards

compliant with the requirements of the NSF for the care of diabetic patients. If a better and equally user-friendly national system becomes available, we would hope that our data could be imported into such a system. In the interim, we have obtained a system that meets our needs.

We have been having meetings with ophthalmologists and planners from six district general hospitals to share methods and adopt common standards.

We are switching to digital cameras with viewing stations and a fileserver. In time, the images should be available to authorised users over a network and eventually over NHSnet.

Our emphasis will be on connectivity with other systems. Digital imaging should reduce the complexity of our current practice as we will be able to assess patients immediately rather than when films return from processing. We are seeking a means for transmitting the results of eye screening directly to GP computers in a manner similar to transmission of laboratory results.

Stephen Cercoran. General Practitioner, The Torrington Speedwell Practice, with a part-time clinical attachment at the North Middlesex Hospital.

Benjamin Graham, Mathematics Student, St Edmund Hall, Oxford.

References


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Videoconferencing proves a healthy choice for Trent

The NHS Trent Region covers 6051 square miles in an area stretching from South Yorkshire to Leicestershire and from Lincolnshire to Derbyshire. A key element of the tasks of the Regional Office is to ensure that government policy is implemented and that key performance targets are met by the local health organisations in order to improve patient care and access to services. Meetings and liaison between the Regional Office’s staff and their counterparts in the NHS trusts and health authorities are common. Videoconferencing was seen not only as a cost and time-saver through reducing the amount of travel involved but also as a valuable management aid to more effective communication, especially for organisations based on several sites or working across boundaries.

A procurement process was organised through the Government Catalogue (GCat) operated by ComputaCenter. From a short-list of three contenders, Questmark Europe was selected to plan and manage the project, install the equipment and to train and support Trent Region’s staff. In the initial stage eleven health authorities and the Regional Office itself were equipped with a Polyspan Viewstation meeting room system. This was chosen for its simple operation, video and audio quality, and its support for input from other media and sources.

The response from users has been very enthusiastic. Staff ranging from middle managers and clerical staff to chief executives are using the system, which gives them a direct video link to all eleven health authorities and several trusts. The network is being steadily expanded as more organisations realise the benefits of installing the system.

It is now also being used in clinical care. The Region has an acute cancer trust, with multidisciplinary teams based across four hospitals in Louth, Grantham, Boston and Lincoln. Trials have been undertaken to see how videoconferencing can assist these teams beyond the normal functions. The trials have covered every aspect of cancer care from diagnosis through to bereavement, a chain that involves many people from different specialties. The most successful have been in the diagnostic field where x-rays transmitted via a document camera are, in the words of one senior consultant, “as good as seeing them on a normal lightbox”. Similarly, by taking the output from a standard microscope, cancer specialists have been able to make diagnoses from slides by viewing them on the videoconferencing system. As a result of these trials, systems have been installed in each of the four hospitals.