Eyetrack® (ET) vs the conventional paper record (CPR): a study comparing the accuracy and speed of data retrieval from glaucoma patient records

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Abstract

Purpose To compare patient data retrieval between electronic patient record systems (Eyetrack®) and conventional paper records (CPRs).

Methods A total of 20 long term glaucoma patient records held on Eyetrack were randomised into two collections with 10 CPRs and 10 Eyetrack records in each collection. The Eyetrack records of one collection were the CPRs of the other collection and *vice versa*.

Four doctors, as two groups, were assessed on a separate collection of records. The time taken to answer 10 questions and the accuracy were assessed. Comparison was made of the answers between the two formats. A month later each group was assessed on the 10 CPRs of the other collection. An expert Eyetrack user was assessed on only the 20 Eyetrack notes. Comparison was made between the 20 CPRs the doctors were assessed on and the 20 eyetrack records.

Results In the first comparison, the mean time for all the doctors to answer the questions on a CPR was 324.4 (±106.0) s compared to 104.8 (±34.0) s for Eyetrack (Mann–Whitney, $P < 0.01$). Mean accuracy for a CPR was 84.0% (±13.0%) compared to 98.0% (±4.0%) for Eyetrack (Mann–Whitney, $P < 0.01$). Comparing the expert Eyetrack user with the CPR showed a mean time for Eyetrack of 96.6 (±34.8) s compared with 283.7 (±63.9) s for CPR (Mann–Whitney, $P < 0.0001$). Mean accuracy for Eyetrack was 97.5% (±7.2%) compared to 82.0% (±8.7%) for CPRs (Mann–Whitney, $P < 0.0001$).

Conclusions An improvement of 3 min 40 s per record was observed with Eyetrack. Accuracy was also improved. Similar results were also found comparing an expert Eyetrack user with CPRs.

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Introduction

The UK government intends for all medical records to be electronically based by 2005.¹ Although there is evidence this deadline is ambitious, when eventually implemented, aside from the usual drawbacks of computers, the advantages should be numerous; clinicians and other health-care workers having instant access to a patient's medical record whenever and wherever it is required, elimination of the 'missing notes' or 'notes coming' scenario and enhanced clinical audit and research.

Electronic patient records (EPRs) are well established in primary health care with many practices being entirely paperless.² Many aspects of health care have been shown to be enhanced when comparing EPR consultations to CPR consultations.³

Only a few hospitals have attempted to introduce EPRs for routine clinical purposes with very few reports on the use of EPRs in Ophthalmology. This is probably due to the lack of uptake of EPRs in Hospital Medicine. The Vitreo-retinal Department at Moorfields Eye

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Hospital has implemented an EPR system and shown many positive aspects (eg audit time reduced from 9 working-man hours for CPRs to 45 s for EPRs).⁴

At present, there are no published studies outlining the use of EPRs in glaucoma patient care. EPRs come in two basic subtypes—Electronic Notes (EN) and Patient Administration and Management systems (PAMs). Eyetrack is a PAM-based EPR for use with the management of glaucoma patients. It was introduced in the Ophthalmology Department at the Queens Medical Centre, Nottingham in 2003. The program is easy to navigate and particularly suited to dealing with numerical data. There are graphs for serial data visualisation (eg intraocular pressure) supplemented with data indicating interventions and therapy chronologically. In addition, pop-up menus aid with management of various types of glaucoma and GP letters are automatically generated. One of the major worries at the time of introduction was that as doctors were so familiar with CPR, when EPRs were eventually implemented, consultations would be markedly slower and worsen an already critical situation with clinic waiting times. The study we present shows a comparison between patient records on Eyetrack and CPR, regarding the speed of data retrieval, of indices relevant to glaucoma management on a follow-up visit. The accuracy of the data collected between the two groups was also compared.

Materials and methods

A total of 20 glaucoma patients who had been seen at the QMC, Nottingham for at least 10 years (mean number of visits, 32 per patient) had their CPRs transferred retrospectively on to the Eyetrack program (Koppens J, Suleman H). The patient records were randomly assigned into two collections, A and B. Each collection had the CPRs and the Eyetrack records of the same 10 patients.

Four doctors were randomly allocated to two groups, A_{doc} and B_{doc}. The doctors were of grade SpR1 and above and had no prior experience of Eyetrack or any other EPR system.

Each group was randomly assigned a collection of records, where they were assessed on the Eyetrack records of that particular collection and the CPR records of the other collection. The results were noted (1st part of the study).

After 1 month, all the four doctors were assessed on retrieving data from 10 CPRs, which were the counterparts of the 10 Eyetrack records they had originally been assessed on. This meant that each doctor had been assessed on a total of 20 CPRs and 10 Eyetrack records. The lapse was such that the doctors could not

Table 1 Allocation of notes

Doctor group	Notes of collection		
	A	B	2nd part, CPR notes of collection
A _{doc}	ET	CPR	A
B _{doc}	CPR	ET	B

mentally recall answers from the previous Eyetrack record assessment. The data from this further assessment of 10 CPRs was used in various analyses (2nd part of study) (see Table 1).

Each doctor in a group was assessed on the same 30 sets of records according to the protocol below. Assessment was in the form of 10 clinical questions (Appendix A) related to the follow-up care of a long-term glaucoma patient.

An expert user of Eyetrack (Vernon SA) was assessed on retrieving the same data from the Eyetrack records of all 20 patients.

Protocol

Each of the four doctors underwent a 1 h training session on the use of the Eyetrack program. Prior to the assessment session, the doctors were allowed 30 min to 'play around' with the Eyetrack program with a false database of patients. In the assessment session, each doctor was given the question sheet (Appendix A) and briefed with information on how to answer each question. In all, 10 clinical questions were asked on every set of records, in a standard manner, and the time taken for the answer noted by the assessor (Suleman H). Assessment was in two sessions for each of the two doctor groups. The expert Eyetrack user was assessed in one session.

The Eyetrack records were taken as the gold standard and the doctors' answers were compared with the assessors' answers taken from the Eyetrack records. Accuracy was assessed as 1 point for a correct answer and 0 points for an incorrect answer. The final score was out of 100 for the 10 records in a particular collection. Where there was a disparity between the answer of the doctor for CPRs and the assessors' answer, the CPRs were checked again looking for potential transcription errors that could have occurred when the records were transferred from CPR to Eyetrack.

Results

The results in Table 2 below compare the times and accuracy of the answers that the doctors gave for the first part of the study.

Table 2 Mean times and mean accuracy for the 1st part of study

	Doctor 1		Doctor 2		Doctor 3		Doctor 4	
	Time (s)	Accuracy (%)	Time (s)	Accuracy (%)	Time (s)	Accuracy (%)	Time (s)	Accuracy (%)
<i>Paper Record (CPR)</i>								
Mean	239.8	86	336.9	93	346.7	81	374.1	77
SD	128.2	13	72.6	11	94.8	9.9	81.1	14.9
<i>Eye Track</i>								
Mean	85.3	98	106.2	98	108.6	97	119	99
SD	31.7	4.2	39.8	4.2	21.1	4.8	36.3	3.1

Graph 1

The mean time taken to answer the 10 questions and the accuracy of the answers on each patient record for Eyetrack were compared with the mean time for the CPR group.

The mean time to answer the 10 questions on one Eyetrack record from both collections of records was 104.8(±34.0)s. The equivalent time for one CPR was 324.4(±106.0)s (Mann–Whitney, $P < 0.01$). No significant interobserver error was found (Mann–Whitney, $P > 0.01$). See Graph 1. Mean accuracy was 98%(±4.0%) and 84.0%(±13.0%) for Eyetrack and CPR, respectively (Mann–Whitney, $P < 0.01$).

The results in Table 3 relate to the second set of CPRs and the expert on Eyetrack. Comparing an expert on the use of Eyetrack *vs* the CPR results for the doctors showed that the mean time for each Eyetrack record was 96.6(±34.8)s. The overall mean time for each CPR was 283.7(±63.9)s (Mann–Whitney, $P < 0.0001$).

Mean accuracy for Eyetrack records was 97.5%(±7.2%) and the combined mean accuracy for all four doctors on CPRs was 82.0%(±8.7%) (Mann–Whitney, $P < 0.0001$).

A comparison of the mean time for an expert using Eyetrack to answer the 10 questions on an Eyetrack record compared to the mean of the four doctors on an Eyetrack record showed similar times, 96.6(±34.8) and

104.8(±31.2)s, respectively. Mean accuracy was 97.5%(±7.2%) and 98.0%(±3.4%), respectively.

A comparison of the mean time taken for the doctors to answer the questions on one record from the first collection of 10 CPRs to the second collection of 10 CPRs showed times of 324.4(±106.0) and 243.0(±91.0)s, respectively (t -test, $P < 0.0001$), with a mean accuracy of 84.3%(±13.2%) and 79.8%(±14.0%) (t -test, $P > 0.1$).

Discussion

The above results clearly demonstrate that it was on average 220 s quicker to answer the 10 questions on an Eyetrack patient record compared to a CPR. If applied to a clinic with 10 follow-up patients per doctor and asking the same questions, the time saving would potentially be 37 min per doctor.

The above results also show a statistically significant improvement in accuracy with Eyetrack records. In an ever increasingly litigious society, improved accuracy of medical data retrieval should help doctors in reducing errors.

This was a prospective study using retrospective data. Transferring the data from conventional paper records onto Eyetrack usually took between 1 and 2 h per record depending on the complexity of the patients glaucoma history. As was mentioned in the protocol, where there was a disparity in the answers of any of the doctors for CPRs and the assessor using Eyetrack, the CPRs were rechecked for the answers given by the doctors. This revealed seven transcription errors in total for 20 sets of records (as there were 10 data points transcribed from each record, this gives seven transcription errors in 200 data points). The transcription error rate is 3.5 errors per 100 data points. An incorrect answer, by a doctor, was converted into a correct one if there had been a transcription error and the doctors answer corresponded with the correct answer.

The above findings only apply to the 10 questions used in this study. If different questions were asked, then

Table 3 Mean times and mean accuracy for the 2nd part of study comparing doctors (CPR) and expert (Eyetrack)

SAV (ET)			Paper records							
			Doctor 1		Doctor 2		Doctor 3		Doctor 4	
	Time (s)	Accuracy (%)	Time (s)	Accuracy (%)	Time (s)	Accuracy (%)	Time (s)	Accuracy (%)	Time (s)	Accuracy (%)
Mean	97	98	200	82	343	91	289	80	303	76
SD	35	7.2	99	14	78	12	102	12	96	13

different results might have occurred. The questions were designed to reflect the kind of data used in an outpatient consultation by a doctor to make an assessment of a glaucoma patient.

The four doctors in this study each had a total of 1½h training on the Eyetrack program and yet they were, on average, only 8 s slower than an experienced user. The experienced user was familiar with the program for over 12 months. This shows that use of the Eyetrack program is easily assimilated by medical staff of SpR grade.

The patients involved in this study were long term (> 10 years follow-up) and therefore the records were extensive and complex. If records for patients being seen for shorter periods, for example, 3–4 years were used, the complexity and size would necessarily be less and therefore Eyetrack records might not have had such an advantage as shown above. The CPRs used had an Ophthalmic section interspersed among records from other medical specialties. In many cases, due to the average age of glaucoma patients, the non-Ophthalmic sections were far more extensive and tended to obscure the Ophthalmic section. In a department where only eye notes are used, retrieving data from the notes might be expected to be faster.

The improvement in mean time for doctors to collect data from the first collection of CPRs to the second collection of CPRs (a mean improvement of 81.4 s) could be due to either a learning effect, that is, the doctors were simply getting better at collecting data from CPRs or they remembered patients' data from the corresponding Eyetrack records 1 month earlier. The former is the most likely possibility as numerical data would be very difficult to remember accurately after such a time period. Interestingly, the mean accuracy was slightly compromised on the second set of CPR notes, although not at a statistically significant level.

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Appendix A Eyetrack[®] study questions

(1)	What is the highest IOP recorded in the notes, of the right eye?	Number
(2)	What is the highest IOP recorded in the notes, of the left eye?	Number
(3)	What is the lowest IOP recorded in the notes, of the right eye?	Number
(4)	What is the lowest IOP recorded in the notes, of the left eye?	Number
(5)	How many different ocular glaucoma medications is this patient currently using for the right eye?	Number
(6)	How many different ocular glaucoma medications is this patient currently using for the left eye?	Number
(7)	How many different ocular glaucoma preparations has this patient previously tried but is not using at present?	Number
(8)	When did this patient last have visual field assessment?	Date
(9)	What is the lowest mean deviation recorded in the notes of the Humphrey visual field of the right eye?	Number
(10)	What is the lowest mean deviation recorded in the notes of the Humphrey visual field of the left eye?	Number