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Can data in optometric practice be used to provide an evidence base for ophthalmic public health?

Sarah V. Slade[1], Christopher J. Davey[1,2] and Darren Shickle[1]

[1]Academic Unit of Public Health, University of Leeds, Leeds, and [2]Bradford School of Optometry and Vision Science, University of Bradford, Bradford, UK

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Correspondence: Sarah Slade
E-mail address: svslade@btinternet.com

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Abstract

Purpose: The purpose of this paper is to investigate the potential of using primary care optometry data to support ophthalmic public health, research and policy making.
Methods: Suppliers of optometric electronic patient record systems (EPRs) were interviewed to gather information about the data present in commercial software programmes and the feasibility of data extraction. Researchers were presented with a list of metrics that might be included in an optometric practice dataset via a survey circulated by email to 102 researchers known to have an interest in eye health. Respondents rated the importance of each metric for research. A further survey presented the list of metrics to 2000 randomly selected members of the College of Optometrists. The optometrists were asked to specify how likely they were to enter information about each metric in a routine sight test consultation. They were also asked if data were entered as free text, menus or a combination of these.
Results: Current EPRs allowed the input of data relating to the metrics of interest. Most data entry was free text. There was a good match between high priority metrics for research and those commonly recorded in optometric practice.
Conclusions: Although there were plenty of electronic data in optometric practice, this was highly variable and often not in an easily analysed format. To facilitate analysis of the evidence for public health purposes a UK based minimum dataset containing standardised clinical information is recommended. Further research would be required to develop suitable coding for the individual metrics included. The dataset would need to capture information from all sectors of the population to ensure effective planning of any future interventions.

Introduction

The purpose of this paper is to investigate the potential of using clinical data available in primary care optometry to provide the supporting evidence needed for ophthalmic public health, research and policy making. Other health sectors have already recognised that electronic data, initially collected for other reasons, may be used for these additional purposes.[1–4]

In UK medical practice, the introduction and use of electronic patient records (EPR) was driven by a desire to reduce clinical errors, improve patient safety and decrease duplication.[5] Medical records contain diagnoses, prescribing patterns and details of care outcomes, often from birth, that may inform research[1] and public health through improved disease surveillance and monitoring of health inequalities.[6,7] Efforts to improve data quality have included the adoption of clinical coding standards and a requirement for all systems to meet a minimum service specification.[5,8]

The Quality and Outcomes Framework (QOF) provides incentives for general practitioners (GPs) in primary care to improve data on specific health conditions. These data are used for resource management and more recently public health.[2]

In pharmacy and dental practice, data were originally collected to inform centralised payment systems. Pharmaceutical Electronic Prescribing Analyses and Cost (ePACT) data, is now used for audit and research into prescribing patterns of particular medications.[3] The relative ease of coding dental interventions facilitated a substantial dental practice database now used for monitoring clinical performance and for public health.[4]

The scope to conduct similar analysis in eye health is restricted by the different types and formats of data available. Submission of ophthalmic payment claims using paper forms to local offices has limited the availability and reliability of General Ophthalmic Services (GOS) data on routine NHS sight tests and spectacle provision. National statistics are based on sample sizes as low as 1% in some places. Only basic data derived from patient's eligibility for services are reported. No clinical outcomes are captured.[9] Routine data from patients not eligible for an NHS sight test is not available at all: i.e. most working people aged 18–59 in England, Wales and Northern Ireland (all residents of Scotland are entitled to an NHS funded eye examination). The evidence to support the assumed health benefits of optometric intervention e.g. the prescribing of spectacles or routine biennial eye examinations is weak.[10]

Estimates of eye disease prevalence from initiatives such as the National Eye Health Epidemiological Model (NEHEM) rely on data from abroad[11,12] or relatively old UK data.[13] Eye health indicators were added to the Public Health Outcomes Framework in England in April 2013. However, reported incidence rates rely on voluntary completion of the certificate of visual impairment (CVI) and are subject to geographical variation in data collection.[14] The majority of ophthalmology care is undertaken in outpatients.[15] However, estimates of prevalence using primary diagnosis coding in ophthalmology are unreliable as codes are not used consistently and collection of these data are not compulsory for the Hospital Episode Statistics (HES) outpatient dataset.[15]

The introduction of a database of UK based optometry information could provide multiple benefits similar to those realised by other primary care professions including Increased reliability of national statistics on eye health; improved estimates of incidence and prevalence of eye disease; improved data on health inequalities; enabling needs-based commissioning of eye care services; improved evidence to support the perceived benefits of routine optometric interventions e.g. sight test intervals; allowing evaluation of changes in service compared with similar populations elsewhere and facilitating the recruitment of patients to research studies of specific eye conditions.

Both corporate and independent optometric practices have increasingly invested in electronic systems for administration and EPR; either developing their own bespoke solution or using commercial software available from a variety of companies. Information extracted from such systems could form the basis of a UK optometric dataset. In the development of this research project consideration was given to the type of data researchers might require from a dataset to achieve the benefits described, compared with the capability of electronic systems and data already input in optometric practice.

Methods

Evaluation of current software systems

Suppliers of optical practice software were identified from internet searches. A series of informal interviews were conducted with six software suppliers [Acuitas (http://www.ocuco.co.uk/), i-clarity (http://www.topcon-medical.co.uk/uk/products/101-i-clarity.html), IPRO (http://www.ipro.de/en.html), Optinet (http://www.optinetuk.com/), Optisoft (http://www.optisoft.co.uk/), Optix (http://www.optix.co.uk/)] at Optrafair London 2014 with additional follow up by email and phone where required. Each interview covered the specific elements from an eye examination that could be recorded, their format (e.g. menus or free text), how much additional variation might be introduced by the user, whether data were held in practice or on a central server and how readily data might be extracted for uses such as public health.

Data needs of researchers

Comprehensive guidance on record keeping in optometric practice has been written by the College of Optometrists.[16] This concurs with guidance written by others.[17–19] The guidance was used to create a list of metrics that might be usefully included in an optometric practice dataset (*Table 1*). The metrics were presented as an online survey using www.surveymonkey.com (Survey Monkey Inc., Palo Alto, CA). The survey web-link was circulated by email to all academics of lecturer level or above, identified from the websites of UK optometry training institutions, and to all UK public health researchers known to have an interest in eye health. One hundred and two researchers were approached. Responses were collected over 8 weeks from April to June 2014.

Respondents used a 10 point Likert scale to rate the importance of each metric for research, where a rating of 10 indicated the most important and 1 the least. Researchers were also invited to specify any additional metrics they may need. The instructions emphasised a need to prioritise as not all metrics may be included in a final minimum

Table 1. Median Likert scores and inter-quartile range for the metrics ranked by researchers. Metrics grouped as commonly found on a clinical record. Within each group higher scores indicate the data most desired by researchers for extraction and analysis

Metric	Median Likert score (interquartile range)
Patient demographics	
Date of birth	10 (10–10)
Gender	10 (10–10)
Ethnicity	10 (10–10)
Postcode	10 (8–10)
Software assigned ID number	10 (8–10)
Occupation	9 (6–10)
Entitlement to benefits	6 (5–8)
NHS number	5 (1–9)
Other aspects related to patient demographics (specify)	1 (1–6)
Patient name	1 (1–2)
Ocular history and symptoms	
Existing eye conditions at presentation	10 (8–10)
Current treatment for existing eye conditions	10 (8–10)
Reason for presenting for an eye exam	10 (8–10)
Duration of existing eye conditions	9 (7–10)
Details of any symptoms experienced	9 (6–10)
Previous treatment received for existing eye conditions	9 (6–10)
Which eye (or surrounding area) is affected by the symptoms	8 (6–10)
Any other data related to eye health	1 (1–9)
Name of any existing systemic conditions	10 (10–10)
Current medications for systemic conditions	10 (7–10)
Previous treatment for systemic conditions	7 (6–10)
Planned future treatment for systemic conditions (e.g. surgery)	7 (5–9)
Other aspects related to general health	6 (1–10)
Lifestyle choices	
Whether or not the patient is a smoker	10 (8–10)
Whether or not the patient is a driver	10 (7–10)
How much the patient smokes	9 (7–10)
How long the patient has been a smoker	8 (6–10)
If the patient has given up smoking how long ago it was	8 (6–10)
Whether the patient drinks alcohol or not	8 (6–10)
The amount of alcohol that is drunk	7 (4–10)
What sort of hobbies or interests the patient has	7 (4–9)
If the patient has given up alcohol	7 (2–8)
Other aspects relating to patient lifestyle	1 (1–7)
Family history	
Family history of glaucoma	10 (10–10)
Family history of AMD	10 (10–10)
Family history of genetic eye disease	10 (8–10)
Family history of diabetes	10 (10, 7)
Family history of cataract	9 (6–10)
Family history of other eye conditions	9 (3–10)
Family history of heart disease	8 (5–10)

(continued)

Table 1 (continued)

Metric	Median Likert score (interquartile range)
Family history of other systemic disease	6 (1–10)
Family history of spectacle/contact lens wear	6 (3–9)
Other aspects related to family history?	2 (1–7)
Current refraction details	
Monocular visual acuity with current spectacles for each eye	10 (10–10)
Current spectacle prescription/refraction details	10 (10–10)
Monocular unaided vision for each eye	10 (7–10)
Binocular visual acuity with current spectacles	10 (7–10)
Current contact lens prescription	10 (6–10)
Binocular unaided vision	9 (6–10)
Type of spectacles worn (e.g. bifocal)	7 (6–10)
Purpose for which spectacles worn	7 (6–10)
Whether spectacles are worn full time or only for specific purposes	7 (5–9)
Any other aspects related to refraction and spectacles/contact lenses (specify)	2 (1–8)
Clinical test results	
Distance visual acuity	10 (10–10)
Refraction result	10 (10–10)
Near visual acuity	10 (10–10)
Tonometry	10 (9–10)
Visual fields	10 (9–10)
Method of fundus examination	9 (8–10)
Clinical signs found in fundus examination (e.g. disc appearance)	9 (8–10)
Binocular vision assessment	9 (8–10)
Motility	9 (6–10)
Ophthalmic drugs used in examination (e.g. mydriatic)	8 (6–10)
Stereopsis	8 (6–10)
Colour vision	8 (6–10)
Pupil reactions	8 (6–10)
Clinical signs found in anterior eye examination (e.g. lid lesions)	8 (6–10)
Amsler	7 (6–10)
Clinical signs found in surrounding eye area (e.g. pigmentation)	7 (6–10)
Results of any other clinical tests (specify)	1 (1–10)
Examination outcomes	
Why the patient was referred	10 (9–10)
If the patient was referred	10 (9–10)
How urgently the patient was referred	10 (9–10)
Who the patient was referred to	10 (9–10)
Whether spectacles/contact lenses were prescribed	9 (7–10)
Whether refraction has changed	9 (7–10)
How much refraction has changed	9 (7–10)
Purpose for which spectacles/contact lenses were prescribed	8 (7–10)
Recommended recall date for the next eye examination	8 (7–10)
Any other information about the advice given to the patient (specify)	6 (1–9)

dataset. Median Likert scale rating and interquartile range for each metric were calculated.

Data availability in optometric practice

A second online survey investigated the nature of computer use in optometric practice. In October 2014 email invitations were sent by the College of Optometrists to a random sample of 2000 of their practising members. The closing date for responses was 1 December 2014.

Invitees were asked to respond even if a computer was not used to gauge the overall prevalence of computer use in practice. Using the list of metrics presented to researchers, respondents who used computers for clinical records were asked to confirm which metrics were recorded, how frequently they were recorded and the format of the data entry.

The results were compared with the data needs of researchers to investigate if the data available might be a useful basis for an optometry dataset.

Results

Evaluation of software systems

The evaluation showed that there was wide variation in the format of data input to current software systems.

A small number of metrics: patient ID number, gender, recall date and refraction data, were entered in a systematic validated format within each of the software systems evaluated. However, the method of entry used was not necessarily the same for each system.

For metrics relating to patient history and test results, two systems allowed multiple metrics to be entered in a single input field and the information was all free text. Three software systems allowed each metric to be entered in a separate field but as free text rather than menu choices. The remaining system offered a separate field for each metric and used drop down menus for information entry, allowing increased consistency in recording for an individual practice. However, the input options available were user specified increasing the probability of variation in data input between practices using the same system.

Some metrics, for example visual acuity, were found to be free text in the majority of the systems evaluated even though it could be straightforward to format the metric as a menu or validated text.

The interviewees reported that software designs were client led and that it was possible to alter the mode of data input if prompted by demand.

Survey of researchers

Forty researchers (39%) responded to the email survey. Median Likert scores are given in *Table 1*.

There was consensus on data extraction for some metrics: 97% wanted date of birth, 94% wanted gender. Similarly, 74% of researchers agreed that it was not necessary to extract patient name. There was less agreement on the inclusion of others: Exactly half the respondents prioritised the inclusion of NHS number and there was a broad range of scores for metrics related to patient lifestyle. The metrics for "other information" had a low mean Likert score in all groups.

Results of survey on data availability in optometric practice

Three hundred and sixty-five members of the College of Optometrists responded to the survey (response rate 18%); 52% reported that the majority of their activity was in the independent sector and 30% in multiples. Employees accounted for 41%, practice owners 25% and 16% were locum or self-employed. Eighteen percent of respondents did not specify the type of practice they worked in or their employment status.

Computer usage was widespread in optometric practice (90%). Their use in multiples (93%) was higher than in independent practice (86%). This difference was not statistically significant ($\chi^2_1 = 3.52$, $p = 0.06$). More than 30 different software packages were in use; the simplest being Excel spreadsheets. Most commonly cited was the Specsavers bespoke system "Socrates" (14%) reflecting the number of respondents who work for Specsavers. Bespoke systems were used by 7.1% of respondents. Acuitas (9.9%), Optisoft (10.4%) and Optix (9.9%) were the most frequently used of the commercially available software systems, the others accounted for less than 4% each.

All optometrists who had access to a computer system within the practice used their computer for a variety of administration tasks. Over half (55%) also used them for EPR. An optometrist was more than twice as likely to input to an EPR if employed in a multiple (independents 37%, multiples 76%; ($\chi^2_1 = 40.46$, $p < 0.0001$). The reasons why the remaining 45% of respondents did not use EPR are given in *Table 2*.

Metrics included in EPR

The proportion of respondents that recorded each eye examination metric in their EPR is given in *Table 3*.

Format of metrics in EPR

The majority of data in practice was entered as free text rather than as validated text or menu options (*Table 3*). Metrics such as postcode and date of birth were often entered as free text even though these would be simple to code. Grading scales were only used in a small proportion of EPRs: Only 9% reported using a grading scale for anterior segment findings, for example.

Was the data collected in optometric practice considered important for other purposes?

There was an association between the importance of a metric as ranked by researchers and the frequency with which they were recorded within the EPR by clinicians (*Table 3*). There were some metrics where the needs of practice and researchers diverged: Recall interval was clearly important to practice as it was recorded in more than 95% of EPR but it was of less interest to researchers. Similarly, ethnicity was considered important to research but rarely recorded in practice.

Was the data collected in optometric practice accessible for other purposes?

Much of the data input in practice was not readily accessible for other analyses as it was entered as free text (*Table* 3). For example, date of birth was of high importance to researchers but was in an accessible format in only 28% of EPRs, and reason for referral data were only accessible in 18% of EPRs.

Discussion

Data would ideally be input to a UK dataset as validated text or drop down menus and not as free text. Individual metrics would be entered in separate input fields and coded using standardised terminology or recognised grading scales to reduce difficulties in data extraction and interpretation and to facilitate timely analysis.

Table 2. Reasons why optometrists surveyed did not use electronic patient records (EPR) in practice

Reasons for not using electronic clinical records (select all that apply)	Response percent	Response count
Content with established paper system	49	67
Too difficult to change from paper to computer records	28	39
No computer in consulting room	22	31
Cost of software	20	28
Considering but not yet purchased	20	27
Low IT knowledge	12	17
Cost of hardware	9	13
Software ordered not yet installed	1	2

Metrics that may usefully be included in a minimum dataset

Researchers did not request any additional metrics for dataset inclusion. This suggested that the list of metrics used in the study covered the aspects important to researchers and could form the basis of a UK minimum dataset. However, as the number of respondents was small it would be valuable to expose any proposed dataset of metrics to wider consultation prior to implementation.

The Likert scores of the metrics given here could help prioritise those metrics most usefully included in the proposed dataset. For example, scores for smoking suggested that it was more important to know whether someone is a smoker rather than the number of years they smoked or when they ceased smoking. Similarly, vision with habitual spectacle correction was given higher priority than unaided vision although both may be helpful.

The difference between the type of metrics recorded in practice and those rated as important by researchers was small. Information on most important metrics was already collected. The implementation of a dataset would not require the collection of much additional data, although it may require a change to the way in which this is entered in EPR.

Information coding and consistency

Although there was plenty of important data in EPRs, much of it was entered as free text giving rise to a high likelihood of data variability and associated difficulties in the interpretation of the data collected. A readily coded metric such as visual acuity may be entered in a number of ways; Snellen, LogMAR, decimal or reading text print size. Unless the scale used is also known, interpretation of a mixed dataset would be difficult. Introduction of standard menus, with the facility to convert to other methods of notation could resolve this difficulty.

There are methods of coding eye conditions[20] and classifying medicines.[21] However, it is possible that these may be overly complex for daily practice. Any coding system adopted should not be onerous and should balance the needs of accurate classification with the practicalities of assuring practice compliance.

Coding of other metrics e.g. visual fields could be problematic given the variety of visual field screeners, screening programmes and the inherent difficulty of describing a field plot. Where visual field data were scanned or attached electronically the files might not be read easily precluding inclusion in analyses.

Further investigation would be required to explore how data could be coded in a meaningful way within a large UK

Table 3. Mean Likert rating for each metric, percentage of respondents that routinely entered, where clinically appropriate, each metric in their electronic patient record (EPR) and percentage of the data that was entered via menus or as validated text to facilitate easy extraction and analysis

Metric	Median Likert score	Data routinely entered in EPR %	Data entered as menu or validated text %
Patient demographics			
Date of birth	10	97	28
Postcode	10	97	19
Gender	10	90	89
Ethnicity	10	13	52
Occupation	9	53	24
Ocular history and symptoms			
Existing eye conditions at presentation	10	75	19
Current treatment for existing eye conditions	10	74	6
Reason for presenting for an eye exam	10	73	14
Details of any symptoms experienced	9	74	7
Duration of existing eye conditions	9	70	1
Previous treatment received for existing eye conditions	9	69	6
Which eye (or surrounding area) is affected by the symptoms	8	74	7
General health			
Name of any existing systemic conditions	10	75	27
Current medications for systemic conditions	10	73	19
Family history			
Family history of glaucoma	10	84	44
Family history of diabetes	10	68	44
Family history of AMD	10	66	44
Family history of cataract	10	52	44
Family history of heart disease	8	36	25
Current refraction details			
Current spectacle prescription/refraction details	10	84	30
Current contact lens prescription	10	77	31
Monocular visual acuity with current spectacles for each eye	10	68	44
Binocular visual acuity with current spectacles	10	39	43
Type of spectacles worn (e.g. bifocal)	8	73	22
Purpose for which spectacles worn	8	64	7
Clinical test results			
Refraction result	10	92	38
Distance visual acuity	10	86	43
Near visual acuity	10	83	43
Tonometry	10	73	40
Visual fields	10	67	49
Clinical signs found in fundus examination (e.g. disc appearance)	9	75	49
Binocular vision assessment	9	70	46
Motility	9	59	54
Method of fundus examination	9	59	62
Clinical signs found in anterior eye examination (e.g. lid lesions)	8	73	48
Pupil reactions	8	72	64
Ophthalmic drugs used in the examination (e.g. mydriatic)	8	72	39
Stereopsis	8	40	37
Colour vision	8	39	43
Amsler	7	52	30
Examination outcomes			
If the patient was referred	10	78	50
Why the patient was referred	10	74	18
How urgently the patient was referred	10	69	26
Who the patient was referred to	10	68	27
Whether spectacles/contact lenses were prescribed	9	84	41
Whether refraction has changed	9	72	43

(continued)

Table 3 (continued)

Metric	Median Likert score	Data routinely entered in EPR %	Data entered as menu or validated text %
How much refraction has changed	9	40	13
Recommended recall date for the next eye examination	8	97	72
Purpose for which spectacles/contact lenses were prescribed	8	71	21

dataset and to explore how additional electronic data such as retinal images or field plots might be incorporated.

Practice participation

Ideally, a UK dataset would be populated by data from all optometric practices. As the invitation was by email the optometrists participating in this study were likely to be biased toward those that use computers, even though the introduction did invite non-computer users to respond. Of these, nearly half only used computers for administration and not clinical records. Some of these were already considering adding EPR to their practice (*Table* 2) however, it is likely that the remainder could be more resistant to the introduction of computerised records (as they are not there already) and may require additional incentives to participate.

The GOS contract for sight tests does not include any requirement for detailed clinical data collection.[22,23] Any additional mandate to require electronic rather than paper records and to facilitate the extraction of detailed data would require a change to the current arrangements.

Population coverage

Approximately 30% of sight tests conducted in the UK are privately funded.[24] NHS sight tests are not generally available to working people aged 16–59 years except in Scotland. To monitor the eye health of the working population it would be important that such data are included. This would require the inclusion of private sight test data in the dataset.

Software and system requirements

As with GP practice,[8] there would need to be specification to which all software suppliers were required to comply to facilitate standard responses among practices. Although it may take time to agree and implement, this may not be a long term barrier to the development of a consistent UK dataset. The developers interviewed included representatives of the three software applications most commonly used by the optometrist respondents. They indicated that they were willing to respond to changing demand.

The technological requirements for an optometry data system might not be prohibitive. The NHS N3 private network has been designed for the use of NHS trusts and other appropriate stakeholders to allow secure transfer of potentially sensitive patient data (www.n3.nhs.uk). GP practices are required to have an N3 connection. However, dental information is input to a central web-based solution using standard internet. Ultimately, a decision would need to be made regarding risk and the sensitivity of the data being transferred to determine the most suitable electronic solution for data transfer and storage.

Unique identifiers and protection of privacy

For some uses of a dataset, such as linkage with secondary care systems to investigate the clinical outcome of an entire patient episode of care, a unique patient code may be required. The lack of consensus amongst researchers in this study on the use of NHS number may have been a reflection of their concern about patient privacy and uncertainty about how the data collected will be used. There are similar concerns about use of patient identifiable data ongoing in medical care.[25] The NHS is moving toward the use of an NHS number rather than using a software assigned number as favoured by participants in this study (*Table 1*). The NHS 5 year forward view states that the "NHS number will be used for safety and efficiency reason in all settings including social care".[26] The NHS standard contract, in use for some enhanced optometry services such as glaucoma referral refinement, has already been amended to include this requirement.[27] It is most likely that an optometric dataset would be expected to use NHS number.

Data may already be used in certain circumstances without patient consent.[28] Projects such as the care.data service have addressed the governance issues around data sharing and patients opting out.[28] In optometry it may be appropriate to amend the patient declaration on the sight test application form (GOS 1) to facilitate consent from NHS patients for other data uses. A similar declaration might be conveniently introduced for private patients. Where data are to be used for research purposes patient privacy could be safeguarded by requiring each access request to be routed via the NHS ethics application process.

Conclusion

Although there were plenty of electronic data in optometric practice, this was highly variable and often not in an easily analysed format. To facilitate analysis of the evidence for public health purposes a UK based minimum dataset containing standardised clinical information is recommended. Further research would be required to develop suitable coding for the individual metrics included. The dataset would need to capture information from all sectors of the population to ensure effective planning of any future interventions.

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