How well does record abstraction quantify the content of optometric eye examinations in the UK?

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Abstract

Background: A recent review found standardised patient (SP) methodology to be the gold standard method for evaluating clinical care. We compared the clinical records describing the content of optometric eye examinations with the actual content, as revealed by SPs.

Methods: We recruited 111 community optometrists in the South East of the UK who consented to be visited by unannounced actors for an eye examination. The actors received extensive training to enable accurate reporting of the content of the eye examinations, via an audio recording and a checklist completed for each clinical encounter. Each participating optometrist was visited by three standardised patients. Upon completion of the standardised patient visits, copies of the clinical records were requested. Using the SP findings as the gold standard, the information gathered from the clinical record was classified for each quality criterion as true positive (reported by SP and documented on the record card), false negative (reported by SP but not documented on the record card), false positive (not reported by SP but recorded on the record card) and true negative (not reported by SP and not recorded on the record card).

Results: Compared to the gold standard, false positives were identified during record abstraction in 4% of cases and false negatives in 18% of cases. For symptoms and history, the proportion of false negatives ranged from 15% to 25% and 3 to 4% for false positives. The proportion of false negatives for tests performed during the eye examinations ranged from 12% to 22% and false positives ranged from 2% to 6%. Optometrists give patients more verbal advice than is indicated in their records (false negatives, 11–19%). Five to 15% of practitioners recorded patient management and advice that was not reported by the SPs.

Conclusions: Our findings regarding optometric consultation mirror the findings in other healthcare disciplines: clinical records are an imperfect representation of the content of a clinical consultation. Clinical records are subject to a recording bias leading to both under- and over-estimation of the care provided due to the presence of false negatives and false positives. This study has important implications for clinico-legal cases, where clinical records are a key item of evidence; and our findings indicate that accurate record-keeping should be a priority for optometric continuing education.

Keywords: clinical practice, eye examination, optometry, quality of care, record card, standardised patient
Council (GOC). Professional guidelines are also provided in the UK by the General Optical Council (2009a), and College of Optometrists (2009a). Although these guidelines are valuable as they provide a plan for standards of professional practice, our literature review of methods of measuring clinical care highlights the fact that clinical guidelines bear little relation to what actually happens in the consulting room (Shah et al., 2007). There have been attempts to gain an insight into the clinical activities of optometrists through questionnaires (O’Leary and Evans, 2003) most notably those administered by the College of Optometrists (Stevenson, 1998). These are useful, but we feel that it is likely that there will be a sampling bias since conscientious practitioners are more likely to respond. Additionally, we feel there is a further potential source of bias with human nature resulting in replies which indicate higher standards of practice than may actually pertain.

A recent literature review revealed that clinical practice is typically assessed by three methods: (1) abstraction of clinical records, (2) clinical vignettes and (3) standardised patients who present unannounced to clinics. Standardised patients are the gold standard methodology for evaluating clinical care (Shah et al., 2007). This approach was used to investigate the content of optometric eyecare for three different patient scenarios (Shah et al., 2008, 2009a,b). The aim of the present paper is to evaluate how appropriately optometric clinical records describe the content of optometric eye examinations. Specifically, this paper summarises a comparison of the data gathered by standardised patients to data obtained by abstraction from clinical records.

**Standardised patients**

During most optometric clinical consultations only two people are present: the practitioner and the patient. So, an appropriate method for determining what the practitioner does is to ask the patient, in particular a patient who has been trained to be an expert observer. There are numerous descriptors of the roles played by individuals during such simulated encounters. The term standardised patient (SP) is a well-accepted term in the literature (Shah et al., 2007).

Standardised Patients are not the only method that has been used to investigate clinical practice and standards, but unannounced SPs with completed standardised patient checklists have been regarded as the gold standard for quality measurement in clinical practice (Dresselhaus et al., 2000, 2002; Luck et al., 2000; Peabody et al., 2000, 2004; Luck and Peabody, 2002; Shah et al., 2007). In order to measure everyday clinical practice, it is important for the SPs to be unannounced: the practitioner must not believe that the SP is there to assess their clinical practice.

In research of this type the practitioner is the research subject. In accordance with the tenets of the Declaration of Helsinki (World Medical Association, 2009), research participants should have the right to safeguard their integrity and should have the right to abstain from participation. Informed consent (Bowman et al., 1992; Ramsey et al., 1998; Barragan et al., 2000; Dresselhaus et al., 2000; Peabody et al., 2000, 2004; Luck and Peabody, 2002; Bachmann et al., 2004) to participate in the study and anonymity (Barragan et al., 2000; Bachmann et al., 2004) of all participants were prerequisites for this study (Shah et al., 2008, 2009a,b).

The requirement for informed consent inevitably reduces the participation rate. To encourage as high a participation rate as possible, we offered two levels of anonymity. The rationale behind this decision is that preliminary discussions with several practising optometrists revealed two main reasons why it was felt that practitioners might decline to participate. First, some practitioners may be anxious that the research would discover shortcomings in their clinical practice which might lead to criticism from colleagues or even disciplinary proceedings. To alleviate such concerns, we offered an option of full anonymity where only the actor knew the practitioner’s name. The second reason why some practitioners may decline to participate is because there was no perceived benefit for the practitioner. To address this objection we offered the option of partial anonymity, which allowed the practitioners to receive feedback that could improve their standard of practice. With this option the researchers and actor, but no-one else, knew the practitioner’s identity and the practitioner received feedback about the content of their eye examination compared with the ‘gold standard’ recommendation of the panel of experts.

**Record abstraction**

Record abstraction has been described as the most widely used method of measuring quality of clinical care (Rubin et al., 1992; Gilbert et al., 1996; McDonald et al., 1997). Record abstraction is sometimes performed simultaneously with the use of standardised patients (Luck et al., 2000; Dresselhaus et al., 2002) and/or clinical vignettes (Dresselhaus et al., 2000; Peabody et al., 2000). Records generated during a clinical encounter are retrieved at the end of the visit for abstraction by a skilled expert.

There are widespread concerns regarding the use of this method due to the validity and reliability of results obtained (Norman et al., 1985; Rethans et al., 1994; McLeod et al., 1997). One of the main limitations is that record abstraction does not identify false negative results i.e., tests carried out but not documented in the clinical record (Dresselhaus
Busy practitioners may not record everything that was examined during the consultation. On the other hand, good record keepers may not necessarily be good physical examiners. The opposite form of bias can also occur; concern over clinico-legal attention might lead some practitioners to record tests that they have not completed (Dresselhaus et al., 2000; Luck et al., 2000). These limitations could therefore skew the results leading to an overestimation or underestimation of the quality of care (Lawthers et al., 1995; Katz et al., 1996).

Other limitations associated with record abstraction include illegibility, incomplete or unavailable records and differing skills between abstractors (Dresselhaus et al., 2000, 2002; Peabody et al., 2000). Record abstraction only provides a limited insight into the practitioner’s clinical skills and practitioner–patient interactions. The usefulness of record abstraction is further limited by the fact that a skilled (and costly) expert must inspect each record to collect the data (Norman et al., 1993; Ashton et al., 1995).

As reported by Dresselhaus et al. (2002), clinical record abstraction lacks both sensitivity due to the presence of false negatives, where the test was carried out but not recorded, and specificity due to false positives, where the test was recorded but not carried out. The presence of false positives gives rise to further questions about the reliability of the record card as a measure of the quality of care provided. SPs are a gold standard measure of the level of clinical care against which both false positives and false negatives in the record card can be measured (Glassman et al., 2000). Several studies within medicine have compared data obtained from record abstraction to that reported by SPs. We know of no research within optometry that has investigated the information gathered from practitioner clinical record cards.

Methods

Sample selection

To practise in the UK, optometrists must be registered with the General Optical Council. Registrants are listed in the ‘Opticians Register’, along with the addresses at which they practise. In order to randomly select practices, the current edition of the Opticians Register was used, which lists the optometrists working in various towns and cities. A map of London and the surrounding counties was divided into four sections: North West, South West, North East and South East. Fifteen towns or cities within an hour and a half travelling distance of central London (excluding those in the inner London area) were randomly selected from each quadrant. This was achieved by listing all the towns and cities in each quadrant in a spreadsheet and using the ‘random number between’ function in Microsoft Excel to generate random numbers (Shah et al., 2008). The random numbers obtained were matched to the corresponding practices in the spreadsheet. A total of 60 towns and cities was selected using this format. The number of optometrists working in each town or city was established from the Opticians Register. A similar method of random selection was used to randomly select 10 optometrists from each of the 60 towns and cities (Shah et al., 2008).

Names of the randomly selected practitioners, their practice details and GOC registration numbers were recorded. The sampling method described here was designed to select more practitioners than required for the study, to allow replacements for practitioners who may change place of work during the course of the study. A total of 600 letters were sent out over a period of 3 months to recruit the 100 practitioners required to participate in the study. All practitioners who did not respond to the initial letter of invitation were telephoned to address any queries or concerns they had about the research. For those practitioners who opted not to participate, an explanation was documented. The details of practitioner non-participation are discussed in another publication (Shah et al., 2008). A total of 111 practitioners consented to participate.

Consenting practitioners were offered a choice of two levels of anonymity:

1. Full anonymity. For practitioners who chose this option, the standardised patient actors (SPs) were given a list of consenting practitioners for them to visit. At the end of the visit, the actor did not record the practitioner’s name or any other identifying features relating to the practitioner. For practitioners who chose this option, there was no way for the researcher to subsequently identify the practitioner who saw the patient. The researcher was therefore unable to obtain the clinical record from practitioners who opted for this option.
2. Feedback for professional development and anonymity in research. This option was designed to give practitioners something in return for their participation, in the form of feedback about the SP’s findings. For practitioners who chose this option, the SPs recorded the name of the practitioner to enable the research team to provide feedback. Upon completion of the SP visits, practitioners who requested this option were invited to send a photocopy of their clinical record card. The data obtained from record abstraction were compared to the SP findings.

Although the optometrists were likely to be expecting visits from SPs, several steps were taken in an effort to ensure that the SPs remained undetected. No practitioners were recruited who were personally known to any of the SPs. Practitioners were only included if they
reported examining at least three new patients a week, and no SP visits took place within a month of the optometrist recruitment. Consenting practitioners were advised the visits would take place at any time over the next 2 years although all three actors completed the visits within 9 months.

Data collection

A random sample of 111 optometrists working within 1.5 h travel from central London was recruited. During the early stages of the study design, it was anticipated that each actor would visit 100 consenting practitioners. A greater number of consenting optometrists than required was recruited to allow for optometrists who may withdraw or change their place of work during the duration of the study. Prior to commencing the visits, the actors were given a list stating the names of all consenting practitioners. The actors were therefore able to select, from this list, the practitioners that they would visit during the course of the study. One hundred consenting practitioners were visited by the SPs in the first and second patient scenarios, and 102 consenting practitioners by the third SP, for a routine eye examination, each representing a different patient scenario (i.e. different ages, races, presenting symptoms and clinical features).

Of the 111 consenting practitioners, 84 optometrists were visited by all three SPs; five optometrists by the first and second SPs; eight optometrists by the first and third SPs; 10 optometrists by the second and third SPs; three optometrists by the first SP only and one optometrist by the second SP only. One consenting optometrist was not visited by any of the three SPs. The methodology detailing the case scenarios, case specific checklists, and the sample selection of participating practitioners are described in papers relevant to each scenario (Shah et al., 2008, 2009a,b). The case specific checklists were prepared during the early stages of the study and completed by the SPs at the end of each consultation were used to abstract the relevant information from the clinical records.

The actors completed a pre-designed checklist immediately after each examination to provide objective feedback for each consultation. The checklists were designed based on evidence-based reviews, clinical guidelines and the views of three expert panels. Results relating to the standardised patient visits have been discussed in the papers relevant to each scenario (Shah et al., 2008, 2009a,b). The aim of this paper is to evaluate how well record abstraction quantifies the content of optometric eye examinations in the UK.

It is usual practice to monitor the standardised patients’ performance throughout the course of the research (Adamo, 2003; Peabody et al., 2004). This is usually achieved either by video-recording or by directly monitoring a clinical encounter (Luck et al., 2000). In the present study the actors were monitored for quality control in two ways. First, after every 20–25 visits they were monitored by attending the Institute of Optometry for an eye examination with a staff clinician. This eye examination was video recorded and the actor completed a checklist in the usual way. The checklist was compared with the video recording for inaccuracies, so that any further instruction could be given if required. If during these checks it was felt that the actor needed reminding of any particular aspects of the eye examination, the video-recording from the training was played back and that particular aspect concentrated on during the quality control eye examination. More details of the training and quality control of the SPs can be found in Shah et al., 2009a.

Participating optometrists were advised that the SPs would present unannounced for the eye examinations and would carry a digital audio recorder during the visits to allow accurate completion of the checklists. The researchers were only given access to audio recording for practitioners consenting to the feedback option. The confidential nature of these recordings was emphasised during the course of the study. Each audio recording was played back by the researcher to ensure that the checklists were accurately completed and this constituted the second quality control check on the SPs’ performance.

Upon completion of all the standardised patient visits, we wrote to practitioners who had opted for the partial anonymity option to advise them all three actors had completed their visits and requested copies of the clinical records for the SP consultations. Practitioners were advised that it was important not to make any changes to their records prior to photocopying them. All relevant information was extracted from the records by an experienced community optometrist using the case-specific checklists completed by the SPs as a template.

Case scenarios

Two of these three SPs were played by professional actors with no prior expert knowledge of eyecare. The SP for the first patient scenario was one of the researchers (RS), who is an optometrist with previous acting experience. All SPs received extensive training to ensure that they could remember and accurately record details of the clinical encounter and to ensure that their acting skills were adequate to avoid detection by participating practitioners.

In the first scenario, the SP presented as a 20-year-old student complaining of headaches (first ever headache 4 weeks ago, with features that might be recognised as migraine). This SP was a myope and presented for
private eye examinations ‘to see if her glasses were OK’, reporting that her last check-up was about 2 years ago (Shah et al., 2008). The second SP presented as a 44-year-old patient of African racial origin for a private eye examination having experienced recent difficulty with her near vision (Shah et al., 2009b). The third SP presented for a private eye examination as a 59 year old patient, with recent onset flashing lights (over the last week) in one eye in the dark (Shah et al., 2009a).

Analysis

The clinical care provided by optometrists was determined by two methods for each of the three standardised patients; first using data gathered from the checklists completed by the SPs at the end of each consultation, and second, by abstraction of information from records obtained from practitioners upon completion of all SP visits. As discussed above, the checklists completed by the SPs were taken as the gold standard method of assessing clinical care. Using the SPs as the gold standard, the data gathered from the clinical records were classified for each quality criterion as true positive (reported by SP and documented on the record card), false negative (reported by SP but not documented on the record card), false positive (not reported by SP but recorded on the record card) and true negative (not reported by SP and not recorded on the record card).

Results

During the early stages of the study, participants were asked to choose which option they preferred, complete anonymity or the feedback option. Approximately one-third chose full anonymity and approximately two-thirds chose feedback or did not state a preference (these were given the option of receiving feedback when the results were available). From those practitioners who opted for the feedback option, 37 practitioners visited by the first SP sent copies of the patient records upon request, as did 34 practitioners visited by the second SP and 40 practitioners visited by the third SP. In total 111 patient records were returned for analysis. Twenty-seven optometrists were visited by all three SPs and of these 23 optometrists sent copies of record cards from all three standardised patient visits, three optometrists sent copies from two SP visits and one optometrist for one SP visit. Fourteen optometrists were visited by two SPs. Of these, 12 optometrists sent copies of clinical record cards from both the SP visits and two optometrists from one SP visit. Nine optometrists were visited by one SP and all nine practitioners sent copies of the clinical records from these visits.

A question that may arise is ‘were the practitioners who returned clinical records a representative sample of the entire population visited by the SPs?’ To investigate (from the SP data) whether the proportion of optometrists who performed a clinical procedure in the record abstraction group, for each scenario \( n = 34–40 \) depending on the scenario) differed from the proportion of optometrists who performed the procedure from the group whose clinical records were not obtained \( n = 62–66 \) depending on the scenario), a statistical test was performed (chi-square test) on the clinical procedures which were of the greatest clinical significance for each scenario. The results showed no significant difference \( p > 0.09 \) between the two groups.

On average, the checklists completed by the SPs at the end of each eye examination consisted of between 70 and 100 items of data. A similar body of data was obtained during record abstraction for the three patient scenarios. Due to the large quantity of data gathered we focus on key data which were of the greatest clinical significance for each specific scenario (Shah et al., 2008, 2009a,b).

Compared to the gold standard of standardised patients, on average false positives (over-reporting) were identified during record abstraction in approximately 4% of cases and false negatives (under-reporting) in approximately 18% of cases (these figures are obtained based on averaging the FPs and FNs across the three SPs reported individually in Table 1). Expressed as a proportion, false positives were higher in the first (4.7%) and third patient scenarios (4.8%) than in the second scenario (3.2%). False negatives were found to be

<table>
<thead>
<tr>
<th>Case scenario 1</th>
<th>Documented</th>
<th>Not documented</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP = 1031 (32.1)</td>
<td>FP = 152 (4.7)</td>
<td>TN = 1596 (49.8)</td>
</tr>
<tr>
<td>Case scenario 2</td>
<td>Documented</td>
<td>Not documented</td>
</tr>
<tr>
<td>TP = 902 (42.2)</td>
<td>FP = 68 (3.2)</td>
<td>TN = 676 (31.6)</td>
</tr>
<tr>
<td>Case scenario 3</td>
<td>Documented</td>
<td>Not documented</td>
</tr>
<tr>
<td>TP = 1169 (33.6)</td>
<td>FP = 167 (4.8)</td>
<td>TN = 1543 (44.4)</td>
</tr>
</tbody>
</table>

Table 1. 2 × 2 tables comparing the gold standard SP findings to the information gathered from record abstraction for three different patient scenarios. The figures represent the total number of measured items (from the case-specific checklists) reported by the SP and findings noted in clinical records (TP); measured items not reported by the SP but documented in clinical records (FP); measured items reported by the SP but findings not noted in clinical records (FN) and measured items not reported by the SP and findings not noted in records (TN).
highest in the second scenario (22.9%) and lowest for the first scenario (13.3%).

The results in Table 2 show that on average optometrists carry out more tests than is indicated by their clinical records. For symptoms and history, the proportion of false negatives ranged from 15% to 25%. For example, 10–12% of practitioners under-recorded asking the SPs if they were taking any prescribed medication, approximately half did not record asking about a family history of diabetes and glaucoma although these questions had been reported by the SPs. Practitioners also commonly under-recorded information relating to the SP’s occupation (7–21%) and whether or not the SP was a driver (10–20%). Specific to the first scenario, 10–60% of practitioners under-recorded information relating to different aspects of the patient’s presenting symptoms. For example, 57% did not record asking about the description of the onset of the headaches, 30% did not record headache duration and 35% did not record asking about the visual associations relating to the headaches. Ten to 50% of practitioners visited by the SP in the third scenario did not record information relating to different aspects of his presenting symptoms of recent onset photopsia. Information describing where in the visual field the SP saw the flashing lights was not recorded in 27% of cases, the presence/absence of a pattern to the occurrence of the photopsia in 32% of cases and 46% did not record if there was a change in the pattern of the flashing lights, although all of these had been reported by the SP as being asked.

The proportion of false positives ranged from 3% to 4% for symptoms and history. Information relating to the patients’ previous ocular history was commonly over-recorded. For example, 19–37% of optometrists recorded that they asked if the SPs had ever been seen at an eye hospital, and 29% recorded that they asked the SP in the second scenario if she had a lazy eye, although neither question had been reported by the SP as being asked. Nineteen per cent of optometrists recorded that they had asked the SP in the first scenario about the duration of the symptoms of the headaches and 11% about the description of the onset of the headaches, although for both symptoms the SP had not reported that these questions were asked.

Another parameter that can be derived from the data in Table 2 is the positive predictive value (PPV). This is the probability that a test was carried out when the test result is recorded, and is derived from the formula:

$$\text{PPV} = \frac{\text{number of true positives}}{(\text{number of true positives} + \text{number of false positives})}$$

Positive predictive value will be poor in cases where there is a high degree of over-recording (false positives). Also derived from the data in Table 2, and highlighted in the Discussion, is the negative predictive value (NPV). This is the probability that a test that has not been recorded was not carried out and is derived from the formula:

$$\text{NPV} = \frac{\text{number of true negatives}}{(\text{number of true negatives} + \text{number of false negatives})}$$

The PPV and NPV values, expressed as percentages, are given in Table 3.

The proportion of false negatives for tests performed during the eye examinations ranged on average from 12% to 22% and false positives ranged from 2% to 6%. Table 4 highlights those tests of particular clinical

| Table 2. The proportions of true positive, false positive, true negative and false negative findings for individual domains of eye examinations performed on three standardised patients. Percentages are shown in brackets. |
|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| **Case scenario 1**             | **Case scenario 2**             | **Case scenario 3**             |
| **Overall**                     | **Overall**                     | **Overall**                     |
| True positive/total responses   | False positive/total responses  | False negative/total responses  |
| (proportion in %)               | (proportion in %)               | (proportion in %)               |
| 1031/3207 (32.1)                | 500/1545 (32.4)                 | 1169/3476 (33.6)                |
| False positive/total responses  | False negative/total responses  |
| (proportion in %)               | (proportion in %)               |
| 152/3207 (4.7)                  | 63/1545 (4.1)                   | 167/3476 (4.8)                  |
| False negative/total responses  | True negative/total responses   |
| (proportion in %)               | (proportion in %)               |
| 428/3207 (13.3)                 | 56/1545 (3.6)                   | 597/3476 (17.2)                 |
| True negative/total responses   | True negative/total responses   |
| (proportion in %)               | (proportion in %)               |
| 1596/3207 (49.8)                | 746/1545 (48.3)                 | 1543/3476 (44.4)                |

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significance to each patient scenario that were commonly under- and over-recorded.

It can be inferred from Table 2 that practitioners offer patients more management advice and options than their clinical records indicate (false negatives, 11–19%). Specific to the first patient scenario, where the SP was presenting with recent onset headaches, 16–35% of optometrists offered, but did not record, management advice regarding the headache diagnosis (i.e. whether the headache was migraine or a tension type headache) and 11–24% offered, but did not record, advice about seeking a medical opinion regarding the symptoms. In the case of the SP presenting with recent onset flashing lights, the SP was advised by optometrists of the need for a dilated fundus examination although this information was not recorded in 15% of cases. This SP reported that 43% of optometrists advised him of the potential adverse reactions from mydriatics, but did not record this advice or record that a leaflet was issued. Ten to 13% of optometrists visited in this scenario either advised the SP to go directly to the hospital eye service or via their GP but did not record this advice.

On the other hand, optometrists sometimes record advice that has not been verbally given to the patient. For example, 5–15% of practitioners visited by the three SPs recorded patient management details and advice issued to the patient that was not reported by the SPs. Advising the SPs of whether an update in spectacles was required and recommending a re-examination interval were two items commonly found to be over-recorded in all three scenarios.

### Discussion

An accurate record of the eye examination is important both for ongoing patient care and to defend the practitioner in the event of complaints or litigation. Guidance on what patient record cards may include is published in the College of Optometrists’ Code of Ethics and Guidance for Professional Conduct (College of Optometrists, 2009a). The College considers that the optometrist has a duty to keep complete and legible records of patients under his/her care (College of Optometrists, 2009a). In addition the General Optical Council states that optometrists must ‘maintain adequate patients’ records’ (General Optical Council, 2009a). The College of Optometrists advice on record keeping includes the following key points:

1. The patient record should provide an ongoing picture of the patient’s need for vision care (both sight and health) as identified during visits to the practice, of how those needs are met, and all subsequent services provided.
2. The patient record should provide details of any sign of injury, disease or abnormality, which the eye examination may have revealed.
(3) Whatever the design of the record card, what matters is to record the relevant information in an accurate and detailed manner.

In view of the guidelines discussed above, good clinical records should summarise discussions between the patient and the practitioner, test results, and conclusions (Warburton, 2004). Accurate records help the optometrist make a decision at the time of the consultation based on the patient’s presenting symptoms and provide a contrast with any symptoms the patient may develop at a later date (College of Optometrists, 2009b). As an example, an optometrist may have noticed early lenticular changes during an eye examination although the patient may be asymptomatic at the time. The patient returns at a later date with symptoms attributable to the cataract. If the lenticular changes had been clearly recorded, it would be easier to explain the cause of the symptoms to the patient (College of Optometrists, 2009b).

**Reliability of the standardised patients and record abstraction**

It has been assumed in this research that SPs are the gold standard against which clinical records should be compared. The safety of this assumption will now be evaluated. Previous research has described unannounced SPs (and completed standardised patient checklists) as the gold standard for quality measurement in clinical practice (Dresselhaus et al., 2000, 2002; Luck et al., 2000; Peabody et al., 2000, 2004; Luck and Peabody, 2002). Luck and Peabody (2002) demonstrated the validity of SPs to measure the quality of physicians’ practice, as the gold standard, by covertly tape recording the SP visit. At the end of the visit, the SPs reported on the physician’s performance by completing a checklist to ‘score’ the consultation in the usual way, but the tape recordings were also independently ‘scored’ by experts. The level of agreement was very high (sensitivity 95%, specificity 85%) and the authors concluded that SP assessment is a valid measure of the quality of care (Luck and Peabody, 2002).

One of the main drawbacks of using the same SP for several clinical encounters is the need for them to continue to portray themselves as a ‘non-expert’ patient. Having undergone several examinations, SPs may begin to volunteer information during the course of the examination thereby prompting the practitioner (Adam-o, 2003). It is therefore usual practice and important in SP research to train and monitor the SPs’ performance for quality assurance (Adam-o, 2003; Peabody et al., 2004). This is usually achieved either by video-taping or by directly monitoring a clinical encounter (Luck et al., 2000). In order to ensure the checklists were completed accurately in this study and SPs were consistent in their responses, we took further measures to those used in previous SP studies by listening to the audio recording obtained from the visits (discussed above) and performing video-recorded eye examinations after every 20–25 visits.

Luck et al. (2000) showed that medical records were neither a sensitive nor a specific report of the clinical encounter. Moreover, since the differences in scores they measured between record abstraction and standardised patient checklists ranged from −10% to +23% for different aspects of the consultation, it is not possible to apply a ‘correction factor’ to convert scores based on record abstraction to an equivalent for SP data. We feel that there is a large body of research supporting our choice of SPs as the gold standard with which clinical records should be compared.

The study was designed to assess clinical records using optometrists’ normal recording procedures and, therefore, a standardised record card was not used by the consenting practitioners. The essence of the SP approach is that it recreates as far as is possible the normal environment for each practitioner’s clinical activities. Using a standardised record card would introduce an element of artificiality, and SP research is based on reducing artificiality to a minimum. Furthermore, any study that imposed a standardised record card on the participating optometrists would run the risk of introducing bias, as practitioners may modify their routine and style of record keeping to suit the record card. In this study, our participating optometrists inevitably used a range of record card types and a range of styles of record keeping. The record abstraction was performed by a researcher (RS) who frequently works as a locum optometrist in a wide variety of practices. As a result, she is familiar with different types and methods of record keeping. Most importantly, her interpretation of the records is likely to reflect the interpretation by a typical locum optometrist who may examine the patient at the practice on the patient’s subsequent visit.

**The clinical significance of over- or under-recording**

From a literal perspective, it could be argued that clinical records should accurately reflect what actually happened in the consultation and any over- or under-recording is unacceptable. However, a fairer view might be that records can only be a summary of the clinical event, and in a busy clinical setting it is almost inevitable that some over- or under-recording will on occasion occur. Some instances of over-recording may, arguably, seem to reflect reasonable assumptions. For example, recording near acuities as N5, although they were not actually measured, since distance acuities were 6/5 and an appropriate addition was given in the absence of media opacities. Although recording a test result when
the test was not carried out can only be described as an error, this circumstance could be described as a trivial error. It is important to note that the distinctions between minor and major errors discussed here are arbitrary and reflect the views of the authors.

Our research has also identified more serious errors. For example in our SP scenario 3, 8% (three optometrists) of records we obtained, recorded checking for pigment cells in the anterior vitreous (Shafer/C213's sign) although this had not been reported by the SP and 3% (one optometrist) checked for Shafer/C213's sign but did not record his/her findings. The SP in this scenario presented for an eye examination with recent onset symptoms of flashing lights. The detection of retinal pigment granules (tobacco dust/C213) in the vitreous is a reliable indicator of the presence of a retinal break (Brod et al., 1991; Lightman and Brod, 1994). It is therefore not only worrying that 87% of optometrists visited in this scenario did not examine the anterior vitreous for the presence of pigment cells (Brod et al., 1991; Shah et al., 2009a) but of concern that optometrists are checking for this important sign and not recording the results of the test and vice versa.

A second example of a potentially serious error is recording the results of a fundus examination despite it not being performed. One practitioner visited by the actor in the first patient scenario did not examine the ocular fundus by any method although they had identified the headaches as the key symptom (Shah et al., 2008). This optometrist recorded their findings as if ophthalmoscopy had been carried out. The practitioner’s guess of the C/D ratio as 0.2 was markedly different from the actual C/D ratio of 0.5 in each eye. In the normal order of events, the patient would have returned for their next examination 2 years or so later and the error may have caused alarm and possibly an unnecessary referral.

Optometrists over-recorded motility (SP1 = 16%, SP2 = 6%, SP3 = 10%) and pupil reactions (SP1 = 19%, SP2 = 3%, SP3 = 10%) in a similar pattern for each test, although for both tests there were marked differences between the results for each scenario (Table 4). It has been recommended that optometrists carry out motility on all new patients, on children during every eye examination, and on adults presenting with new symptoms and periodically over the years as adults are monitored (Evans, 2005). In view of the importance of this test and the fact that all three SPs were new patients to the practices visited, it is notable that motility was performed by only 38% of optometrists visited by SP1, 50% visited by SP2 and 35% visited by SP3, with interesting patterns of under-recording (SP1 = 3%,
Clinical assessment of the pupil responses to light is a neurological test that elicits important information about the health of the iris, retina, visual pathway, sympathetic and parasympathetic pathways. Again in view of the clinical significance of this test, it is notable that pupil reactions were only assessed by 73% of optometrists visited by the first SP, 91% visited by the second SP and 73% visited by the third SP, with interesting patterns of under-recording (SP1 = 5%, SP2 = 24%, SP3 = 15%) and over-recording (SP1 = 19%, SP2 = 3% and SP3 = 10%). In scenario 2, pupil reaction testing had a very low NPV (20%), indicating that when pupil reactions were not described in the clinical records then it was still very likely that they had in fact been tested.

As seen from Table 4, 60% of optometrists visited by the SP in the third scenario recorded prescribing a correction for intermediate vision different to that established for near/reading although testing at this distance had not been reported by the SP. It could be argued that these optometrists estimated the intermediate addition based on their knowledge of the SP’s intermediate working distance and the near addition established for a different working distance (near visual acuity, N5). It is questionable whether this is a valid approach, particularly in this scenario where the SP presented as a music teacher (Shah et al., 2009a), using different strengths of ready readers depending on the distance at which he was working.

Objective assessment of the refractive error (autorefractor and retinoscopy) was commonly found to be under-recorded for all three SPs. The importance of recording these data is debatable as these results are not essential to providing a final prescription. However, results of objective assessment, particularly retinoscopy, could be invaluable to the optometrist for reference in the future care of the patient. For example, retinoscopy might reveal that a patient (new to the practice) had significant hyperopia either because the patient was amblyopic or had latent hyperopia. The optometrist may not prescribe the full hyperopic prescription following subjective testing. If the patient returns to the same practice for an eye examination and is examined by a different optometrist, it would be useful for the optometrist to have the previous retinoscopy findings.

Thirty-five per cent of optometrists whose records we obtained following visits from the first SP did not record performing binocular balancing at the end of the monocular subjective refraction although this had been reported by the SP. The aim of binocular balancing is to balance the accommodative effort in the two eyes, by uncovering any extra hyperopia which is manifest when the patient is binocular (Harvey and Franklin, 2005). In cases where a full monocular subjective refraction has been performed with binocular balancing incorporated as part of the routine, it is debatable whether it is necessary to record the findings of binocular balancing separately. Furthermore, 14% of optometrists visited by this SP performed a binocular refraction and in these cases binocular balancing of the accommodation is not a discrete process and therefore would not be recorded (Elliott, 2003). Binocular balancing and the +1.00 D blur test can be considered part of the subjective refraction routine, at the end of which the final subjective prescription is recorded. Twenty-two per cent of optometrists visited by this SP also under-recorded their findings of the SP’s accommodation. Although the importance of recording accommodative findings in an asymptomatic patient is debatable, records of previous findings could be helpful in the future care of the patient.

The results of fixation disparity tests were also commonly under-recorded for all three SPs. Although minimal under-recording was found for the cover test, it is important to record the results if fixation disparity was checked. This is particularly important in the first scenario since decompensated heterophoria can be associated with migraine (Harle and Evans, 2006). The PPV for fixation disparity testing in scenario 1 was 71% for distance and 60% for near, indicating that results were often recorded (typically, as normal) even when the test had not been carried out.

Optometrists who sent copies of their clinical records upon completion of the SP visits commonly under-recorded (SP1 = 27%, SP2 = 24%, SP3 = 18%) having carried out an anterior eye examination with the biomicroscope. However, there was also an apparent over-recording (SP1 = 16%, SP2 = 6%, SP3 = 3%) by practitioners of their findings of anterior eye examination using a slit lamp biomicroscope. It is likely that at least part of this apparent over-recording resulted from optometrists who used a direct ophthalmoscope to examine the anterior eye, a method which would not have been detected by the SP. The Optician’s Act 1989 requires an optometrist to perform an examination of the external surface of the eye and its immediate vicinity for the purpose of detecting signs of injury, disease or abnormality in the eye or elsewhere (General Optical Council, 2009b). The Act does not state that a biomicroscope has to be used, although these are readily available in most practices today. Alternatives to a biomicroscope, which would be particularly relevant in a domiciliary setting, are a direct ophthalmoscope or a simple hand held loupe with a pen torch or hand held slit beam torch (Harvey and Franklin, 2005). It is notable that 65–84% of practitioners whose record cards we obtained did not
record the examination of the anterior eye by any means.

The results in Table 4 relating to fundoscopy show that optometrists do not always record the instrument used to examine the fundus. Optometrists who examined the fundus using binocular indirect ophthalmoscopy (BIO) with a slit lamp biomicroscope frequently failed to record (SP1 = 22%, SP2 = 12%, SP3 = 15%) the method used. The method of fundus examination is important as this dictates the view of the fundus obtained. For example, the SP in the third scenario presented with recent onset photopsia. A binocular indirect viewing technique such as slit lamp BIO provides a wider field of view (approximately 20–30° of the fundus compared to 10° using a direct ophthalmoscope, although recent advances have led to the development of a wide field direct ophthalmoscope with a 25° field of view) allowing easier localisation of lesions and providing greater magnification depending on the magnification of the lens used (Doshi and Harvey, 2005). Hence peripheral retinal examination in this patient using a direct ophthalmoscope and slit lamp BIO may result in different findings depending on the instrument used. If the optometrist used a ‘Super Vitreo Fundus’ lens, this would give a better view of the periphery than if for example a 78 D lens was used. Not recording the technique used, particularly in the case of this patient, does not in itself mean the optometrist is not taking reasonable care, but a detailed record facilitates future patient care and makes it easier to defend any clinico-legal allegations.

Optometrists visited by the SP in the first (8%) and third (10%) patient scenarios under-recorded performing a visual field assessment on the SPs although this information was reported in the case-specific checklists. It could be argued that the findings were not recorded because the visual fields were full. However, a record of a normal finding could be important if a defect was found at subsequent appointments. Although none of the optometrists visited by the first SP over-recorded performing this test, 3% of optometrists visited by the second SP, and 8% visited by the third SP, over-recorded the visual field test findings. All these optometrists recorded that the visual fields were normal. In these cases, if the same patients were to present for an eye examination at a later date during which a loss in their visual field is noted, the optometrist could unknowingly mismanage the case.

Table 4 illustrates that optometrists also under-recorded tonometry findings albeit to a lesser degree than the proportion that under-recorded visual fields. It is useful to have a baseline measurement of IOP on all patients to aid interpretation of future readings (Doshi and Harvey, 2005). Hence in the case of the two optometrists (3%) who assessed the patients’ IOPs but did not record their findings, future reference to these results would not be possible. IOP should be quantified as it is a risk factor for glaucoma (College of Optometrists, 2009b). A record of the instrumentation used, individual readings taken and the time at which the readings were taken may be valuable in the future care of the patient. For example, if a non-contact tonometer was used; good practice dictates that more than one reading is taken (College of Optometrists, 2009b). Noting down the individual readings would give the optometrist extra information when building the overall picture of the consultation. If only a single reading was noted, with no record of the instrument used, it would be difficult to distinguish whether this was indicative of an average of three or four readings or whether a contact tonometer was used, and hence only a single reading was taken.

As highlighted in the results above, most practitioners ask more questions relating to the patients’ history and symptoms than they record and similarly give more management advice than they record. These findings are understandable in a busy clinical setting, but are nonetheless undesirable (Warburton, 2004). The proportions of false positives were found to be higher for the first and third patient scenarios compared to the second scenario. It could be argued that these findings reflect the fact that the second scenario was the least symptomatic of the three and a number of optometrists visited by the patient in the second scenario seemed to be unaware of the link between race and glaucoma (Shah et al., 2009b). We speculate that optometrists visited by the SPs in the first and third scenarios were more likely to associate a risk of clinico-legal action due to the nature of the patients’ presenting symptoms which may have increased the tendency to ‘over-record’ in these cases.

As discussed above, practitioners working in busy clinical settings are more likely to under-record tests performed, history obtained and management advice offered, due to time constraints (Dresselhaus et al., 2000; Luck et al., 2000). Although information relating to the practice ambience (busy/quiet) was not gathered in the present research, it would be useful when performing future research for the SP to record this information on the checklist completed at the end of the visit. It would also be useful to have a record of whether the optometrist was running behind in their clinic. The data gathered would allow for comparisons on under- and over-reporting in a busy vs quiet practice setting. A record of the optometrist’s year of qualification would be beneficial in any future comparative analysis of whether differences in the period of qualification have a bearing on the proportions of under- and over-reporting on clinical records.
Limitations of research

Only about one-third of practitioners who were visited by SPs returned their clinical records for the record abstraction study. This was only appropriate for practitioners who had consented to the ‘feedback’ option, approximately 60 practitioners for each SP; and practitioners who had not stated a preference (full anonymity or feedback), approximately 13 for each scenario. So, of the 219 requests that were sent for clinical records to be returned, a participation rate of 51% was achieved. Practitioners who were concerned about their clinical thoroughness or record keeping would have been more likely to decline the invitation to participate in the research, to opt for the ‘full anonymity’ option, or to decline to send in their clinical records. Therefore, we feel that our data are likely to over-estimate the standards of record-keeping in the UK optometric profession.

Another limitation is that our research only involved practitioners working within 1.5 h travel from central London. We excluded practitioners working in the City of London, since these practices are likely to have an atypical patient demographic (e.g. relatively few children and older people). It is also possible that there are geographic variations in the content of optometric eyecare in England that our study could not reveal. We know of no data to suggest this. As a check, we did investigate, using the SP data, for any difference between urban and rural practices, but found no significant differences (Shah et al., 2008, 2009a). This supports our assumption that standards of optometric practice are unlikely to vary greatly in different geographic regions within England. However, it should be noted that improved funding arrangements for NHS primary eyecare in Scotland and Wales (Association of Optometrists, 2009) mean that our data are unlikely to reflect the situation in these regions with evidence already indicating that standards have been raised (Ang et al., 2009).

An additional limitation of this study is that some practitioners (23) contributed clinical records for all three scenarios, some for two (15) and some for just one scenario (12). Therefore, the total sample of 111 responses is not an independent sample; for example an optometrist over-recording a test in the first scenario could also be over-recording the same test in the second and/or the third scenario. For this reason we have, in general, avoided giving overall estimates for false positives or false negatives based on averaged data across all three scenarios. But our data from the three scenarios can be used to provide the likely range of responses. Similarly, we have avoided giving average figures for PPV, NPV and over- and under-recording.

As described in the Methods section, the SP for the first patient scenario was one of the researchers (RS), who is an optometrist with previous acting experience. Whilst all SPs received extensive training to ensure that they could remember and accurately record details of the clinical encounter and to ensure that their acting skills were adequate to avoid detection by participating practitioners, a potential limitation arises in using an optometrist as a SP. The researcher (RS) in this case could be classed as an ‘expert’ and therefore may assess the practitioners’ behaviour and/or approach to the examination differently when compared to the ‘non-expert’ SPs. It is important to note that previous studies using standardised patients used ‘non-expert’ SPs (Dreselhaus et al., 2000, 2002; Glassman et al., 2000; Luck et al., 2000).

As discussed above, the actors used for the second and third patient scenarios were trained to recognise all the techniques used within an optometric eye examination. Specific to the third scenario, the actor was trained in recognising various techniques that are carried out with the slit-lamp biomicroscope. The actor, who was a science graduate before pursuing an acting career, was easily able to identify binocular indirect ophthalmoscopy. During the training sessions, it was established that the actor was also able to reliably detect when the optometrist was testing for Shafer’s sign. This was recognisable when, during biomicroscopy, the patient was asked to rapidly look to each side and/or up and down and then look straight ahead steadily. Whilst every effort was made to ensure that the actors were able to identify accurately the various techniques used, it is important to note that they were unable to assess the precision with which the technique was performed (i.e. the quality of the results obtained). For example, if an optometrist performed slit lamp biomicroscopy using a 90 D lens, although the actor could recognise the technique they would not be able to comment on the quality of the view of the fundus obtained.

Computerisation is changing optometric practice, as in many other areas of life. Most practices now have computerised patient recall systems, but it is still relatively rare for practices to have computerised clinical records. Indeed, <10% of the clinical records that were obtained for this study were print-outs from computerised systems. This proportion is likely to increase over the next few years and it is not entirely clear what impact this will have on clinical record keeping. The anecdotal experience of author BJWE, who has been using one of the most popular computerised optometric clinical record systems for over 1.5 years, is that computerised records result in both more false positives and more false negatives. False positives are increased because it is very easy (one key stroke) to enter the standard, default, entry for a test result as the practitioner rapidly ‘tabs’
through the various fields in the record. Conversely, because different groups of tests are recorded on different ‘pages’ within the system it is easier for the practitioner to forget to complete a group of tests than with paper records, where all the test results are typically completed on one page so that omissions can be readily detected at a glance. It would be interesting for systematic research, using SPs, to investigate these hypotheses.

Conclusions
To conclude, the findings of the present study suggest that optometric clinical records obtained are an imperfect representation of the content of an optometric eye examination. Given time constraints and sometimes the complexity of presenting symptoms, one could argue that optometrists are unable to record every detail of the clinical consultation. Based on the findings of the gold standard eye examinations from SPs, we have found that clinical records include both under- and over-estimations of the clinical consultation. To take extreme examples, in a young adult a near fixation disparity test had only been carried out in 60% of the cases where a test result was reported. In an older patient at risk of glaucoma, in 80% of the cases where pupil reactions were not recorded the practitioner had actually tested these. We recommend that future optometric continuing education and training on record keeping could usefully focus on the importance of recording key tests performed during the eye examination. For example, the importance of recording pupil reactions and visual field examination findings in a patient presenting with headaches (scenario 1) and Shafer’s (positive/negative) in a patient presenting with recent onset flashing lights (scenario 3).

An inaccuracy in the recording of clinical findings raises barriers to the provision of appropriate continued clinical care. It also has implications for clinico-legal cases. If the clinical findings are not recorded, subsequent legal analysis may conclude that they were not performed (Elliott, 2003). In a literal sense, our data show that this assertion is incorrect. Clinical investigations are quite often performed without being reported in records. Less commonly, clinical investigations are recorded, but not performed. What is undoubtedly true is that practitioners will find it much harder to convince a court or disciplinary hearing that they carried out a clinical investigation if this is not documented in their clinical records. Accurate record-keeping serves the interests of the practitioner as well as those of the patient.

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