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Citation: Parkins, D. J., Benwell, M. J., Edgar, D. F & Evans, B. J. W. (2018). The relationship between unwarranted variation in optometric referrals and time since qualification. *Ophthalmic And Physiological Optics*, 38(5), pp. 550-561. doi: 10.1111/opo.12580

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OPO-OA-2426

Title

The relationship between unwarranted variation in optometric referrals and time since qualification

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Keywords: variation, decision-making, referral, optometry

Abstract

Purpose: To investigate variation in optometric referral decision-making and the influence of experience and continuing education and training (CET).

Methods: To gain insight into unwarranted variation in referral activity in the UK: (1) triage data were audited to investigate source of referral, provisional diagnosis, and outcome; (2) an online system was developed to present two sets of ten vignettes, designed to avoid prompting answers. Participating optometrists completed ten pre-CET vignettes, recording their tests and management decisions. The main group of participants chose whatever CET they wished over a six-month period and then completed another ten post-CET vignettes. A second group of newly-qualified optometrists completed the vignettes before and after a CET course intervention, followed by a third group of pre-registered optometrists with an intervention of six-months experience of their pre-registration year.

Results:

The audit identified 1951 optometric referrals and 158 optometrists (211 referrals were from GP practices), with 122 of the 158 optometrists making fewer than ten referrals. Two newly-qualified optometrists generated 12.5% of the total referrals in the audit (N = 2162). Many suspect glaucoma referrals were based on a single suspect measurement resulting in a high discharge rate after community review, as did referrals for certain fundus-related appearances for which no treatment was indicated.

The intervention of gaining CET points appeared to have no significant impact ($p = 0.37$) on referral decision-making, although this part of the study was underpowered. Self-selection bias was confirmed in the main group. When the main group and newly-qualified practitioners were compared, the number of referrals was negatively associated with time since qualification ($p = 0.005$). When all twenty referral decisions were compared, all optometrists referring more than ten vignette patients came from a group of newly-qualified practitioners up to two years post qualification. Pre-registered optometrists generally referred more appropriately than newly-qualified. Upon qualification, there was a significant increase in the number of sight tests undertaken per day ($p = <0.0005$).

Conclusions:

Gaining CET points alone is unlikely to significantly improve referral decision-making. Mentoring and targeted CET for the newly-qualified up to two years post-qualification should be considered. Ophthalmology replies to the referring newly-qualified optometrist are vital for moderating future referrals and developing clinical confidence.

Introduction

Most patients seen by the hospital eye service (HES) are referred by optometrists.^{1,2} Optometrists are reported to generate more false-positive referrals than general medical practitioners (GPs)³, although in referral research the false-positive rate obtained depends on the definition of a false-positive referral. There is variation in the quality and content of optometrists' referral letters and the need for improvement for some practitioners has been indicated.⁴ Published audits attribute significant numbers of false-positive suspect glaucoma referrals to 'optometrists'.^{5,6,7} Frequently, poor positive predictive values are found when referrals are based on a single suspicious finding.⁸ Davey *et al.* identified the impact of an outlier in their audit of referrals.³ Calls for better communication between ophthalmologists and optometrists, and for more replies from

ophthalmologists to optometrists' referrals were being made nearly 30 years ago to improve referrals from '*the minority of optometrists who refer too readily*'.⁹

Evidence of unwarranted variation is found in other professions. A Kings Fund report highlighted variation between GPs, stating that '*Patients with identical conditions may be appropriately managed by one GP but referred by another, if the GP who makes the referral does not have the skills and supporting infrastructure to manage the patient safely*'.¹⁰ Another report '*Better value in the NHS*' suggested that changes in clinical practice were required to reduce waste and inefficiency; citing widespread unwarranted variation in clinical practice and health systems across the country.¹¹

Continuing Education and Training (CET) is a statutory requirement in the UK for all qualified optometrists and dispensing opticians and is overseen by the General Optical Council (GOC). Peer-reviewed evidence on the impact of CET¹² on 'referral decision-making' (and on other aspects of optometric care) is sparse.

Peer discussion groups have been evaluated in Wales, and improvements in referral procedures, patient information and record keeping were reported.¹³ However, knowing when to refer still caused uncertainty for some. Lack of opportunity to use new skills, limitations of locum work and time pressures were offered as reasons by a small number of optometrists for not being able to change practice.

A postgraduate training module has been used to investigate clinical decision-making in glaucoma.¹⁴ Despite an increase in knowledge, no apparent improvement in clinical decision-making was observed. Practice-based training with active learning, such as training sessions in the HES, peer discussion and targeted referral feedback were recommended. An over-cautious approach was suggested as a possible reason for making a false-positive referral.

The aim of this study was to determine the extent of variation in optometric referral decision-making using a) anonymised triage data and b) online vignettes. In the

online vignettes research participants completed a short questionnaire to record time since qualification, workload, type of practice and additional qualifications.

Methods

a) Triage audit

The audit used data from a five-year period between 2007 and 2011. These data were compiled for monitoring a referral management triage process for urgent and routine referrals from optometrists and GPs in a single commissioning area. A community service had been introduced to provide clinical assessment and feedback to optometrists and GPs, with the aim of reducing unnecessary HES referrals and improving the quality of future referrals. The triage process identified a number of referral outliers who subsequently received mentoring and support, but these data had not been subject to more detailed analysis. Only anonymised data from 1st April to 30th June in each year were analysed. This period was chosen as it avoided main holiday periods. Data included source of referral by practitioner code and practice code, triage decision for hospital or community review, provisional diagnosis, and outcome. Exclusions from triage were direct referral after cataract assessment (average number over the three months for the five-year period = 115), emergency same day referrals (no data available on numbers) and two-week suspect wet age-related macular degeneration (AMD) referrals (no data available on numbers). These exclusions were to avoid any unnecessary delay for patients.

Triage decisions were risk-stratified as 'low' for optometrist review (if based on insufficient workup), 'moderate' for community ophthalmologist review (if potential for discharge) or 'high' for HES review (where the provisional diagnosis clearly identified need for ophthalmology review and treatment).

b) Online vignettes

A bespoke website was designed to present vignettes in a structured form to assess clinical and management decision-making. Twenty vignettes were developed from common primary care scenarios and the drafting of the vignettes was informed by professional guidance.¹⁵ Each set (A & B) of ten vignettes included three scenarios where the outcome was a definite referral, three definite non-referrals and four 'grey area' scenarios where there was not necessarily any definite response regarding referral. Topics included in each set (A & B) were cataract (1 vignette), glaucoma (2), retina (2), cornea (1), contact lens (1) anterior eye (1) refractive (1) and orthoptics (1). Vignette quality and scoring of answers were assessed by an expert panel of three ophthalmologists and three optometrists. The online design avoided any prompting of answers by only allowing the content on view to develop as more tests were selected by word input, and the corresponding test results presented (Figure 1). Participants were free to choose suitable tests to complete an examination and made a management decision when they considered enough information had been collected from the tests selected.

The expert panel agreed which tests should ideally be performed for each vignette, with points allocated for each appropriate test selected and with more important tests carrying additional weighting; for example, additional weighting was given to pupil dilation in the case of suspected retinal detachment and to cycloplegic refraction in the case of latent hypermetropia. Management options (e.g. refer urgently, refer routinely, refer GP, information GP, monitor/manage) carried weighted scores aligned to the most appropriate option for that vignette supported by guidance and patient safety. Tests considered as unnecessary by the expert group attracted zero points and were ignored. Individual vignette scores were combined for the Set A and Set B totals. Although both sets of vignettes were similarly matched for difficulty, they did not need to be equally difficult as there was no need or expectation that the difference score should be zero if there was no CET effect.

A pilot was conducted to assess how the vignettes performed in practice, the order in which the sets were presented and the scoring. This involved a group of eight optometrists. As the vignette design used in the pilot study did not permit any change to an answer, the majority of participants requested an option to correct

genuine mistakes or add tests missed out. This resulted in a software change to allow up to three further tests after the management decision. In the consulting room, practitioners can go back and conduct further tests while considering and discussing the management decision with the patient. As vignettes were completed quicker than in normal practice, including this option allowed participants more 'thinking time'. This was supported from qualitative research where it was found that optometrists did not wait until the end of the examination to think about management options but were formulating them throughout.¹⁶ The pilot study also highlighted that participants tended to learn the process on the first vignette and therefore a demonstration scenario was included for completion before the start of Set A.

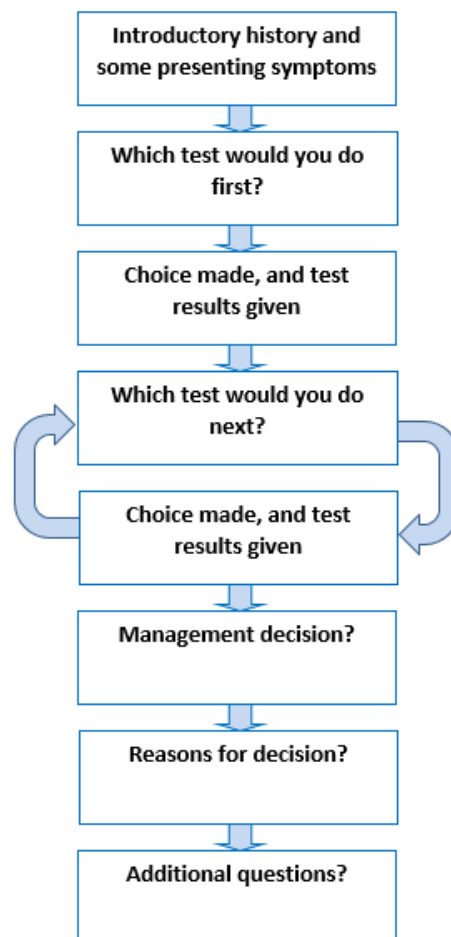


Figure 1. Vignette decision making process

The main group was a cross-section of qualified optometrists who responded to publicity in a variety of media aimed at optometrists across the UK (e.g., College of Optometrists newsletters, optical magazines, email forums).¹⁷ After completing Set A, participants chose whatever CET they wished to undertake over a six-month period from the wide variety of CET available to optometrists in the UK, and then completed Set B. Each participant was asked to send their MyGOC CET points record to the researcher after the six-month period. The dependent variable in the data analysis was the vignette score change (VSC) = (post-CET score minus experts' score) minus (pre-CET score minus experts' score). For example, the VSC for each participant was calculated thus:

Set B actual score = 217, Set B expert score = 251, so (Set B actual – Set B expert) = -34

Set A actual score = 208.5, Set A expert score = 280.5, so (Set A actual – Set A expert) = -72

Therefore, VSC = (-34) minus (-72) = +38

To investigate the 'real-world' validity of the online vignette results, a referral letter audit over one month was conducted on five participants in the main group. The patient anonymised referral letters were assessed and scored for evidence of tests undertaken and quality of content.

Due to lower than expected numbers recruited in the main group and a self-selection bias also identified in the referral letter audit, the study was expanded to include newly-qualified optometrists (NQO) and pre-registered optometrists (PRO) which enabled comparison between groups.

Information on website design, communications, vignette content, vignette and triage data can be found at: <https://optomscenario.wordpress.com>.

Analyses were performed using SPSS Statistics for Windows (IBM Corp. V.21) and Excel (www.microsoft). The following statistical tests were used: Pearson's correlation coefficient test (r) to investigate the relationship between VSCs and

number of CET points; Spearman's rank-order correlation coefficient (r_s) to assess the relationship between the number of referrals and time since qualification; Kruskal-Wallis (H) and Dunn's post hoc pairwise test to compare the number of referrals with each group; and Mann-Whitney test (U) to compare the total number of CET points and total number of peer discussion points over three years in the main group with a GOC sample reference group.

The research was approved by research ethics committees of London South Bank University and Institute of Optometry.

Results

a) Triage Audit

All referrals submitted to the management centre within each three-month period were included in the analysis. Over the five-year period, the audit identified 1951 optometric referrals and 158 optometrists (211 referrals were from GP practices). Analysis highlighted that 122 of the 158 optometrists had made fewer than ten referrals. The practitioner code was unknown in 33% of cases and the practice code unknown in 5.6% of cases

The most notable findings were the number of referrals by one of the optometrists, 'practitioner 1', for visual field only, retinal drusen, early pigmented macular changes and by practitioners 1 and 2 for suspect glaucoma signs of disc only and raised intraocular pressures (IOP) (measured by non-contact tonometry (NCT)) only (Figure 2). Practitioner 1 generated 8.0% of the total number of referrals in the audit (including those without a practitioner code), while all GP referrals accounted for only 9.8%. Practitioners 1 and 2 were coded as NQOs.

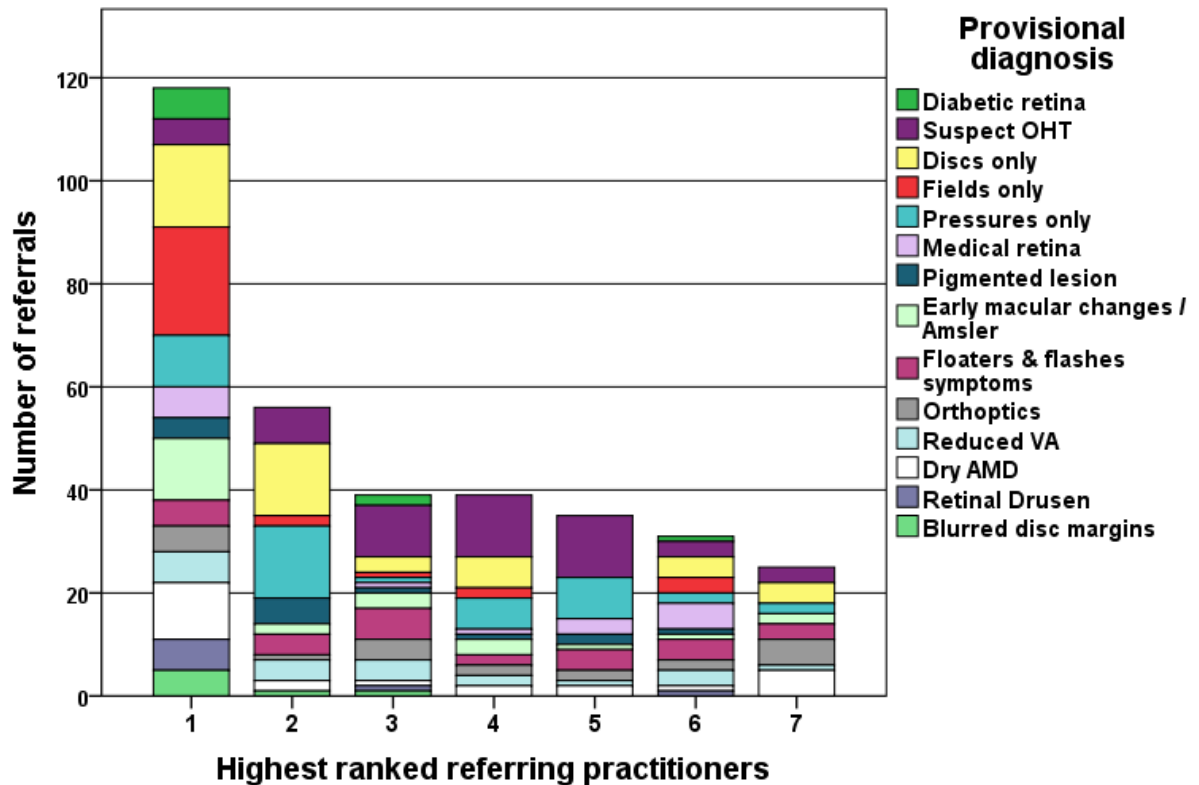


Figure 2. Breakdown of the fourteen most common provisional diagnosis categories by the seven highest ranked referring practitioners (out of 158)

Referrals from practitioners 1 and 2 accounted for a large proportion of the community referral activity. Approximately one half of these two practitioners' routine and urgent referral activity (1 = 53.8%, 59 = 50.0%) was seen in the community service following triage. The resultant discharge rate was 86.7% for practitioner 1 and 71.4% for practitioner 2 (Figure 2).

Overall, a high discharge rate following triage and community review was found for suspect glaucoma referrals when based on a single suspect measurement (IOP by NCT, disc assessment or visual field). Referrals for certain fundus appearances also resulted in a high discharge rate for cases where no treatment was indicated. Small flat pigmented lesions and early macular changes (as assessed in patients with good visual acuity and slight distortion on Amsler chart) were the two largest types of fundus-related conditions resulting in the highest referral rates.

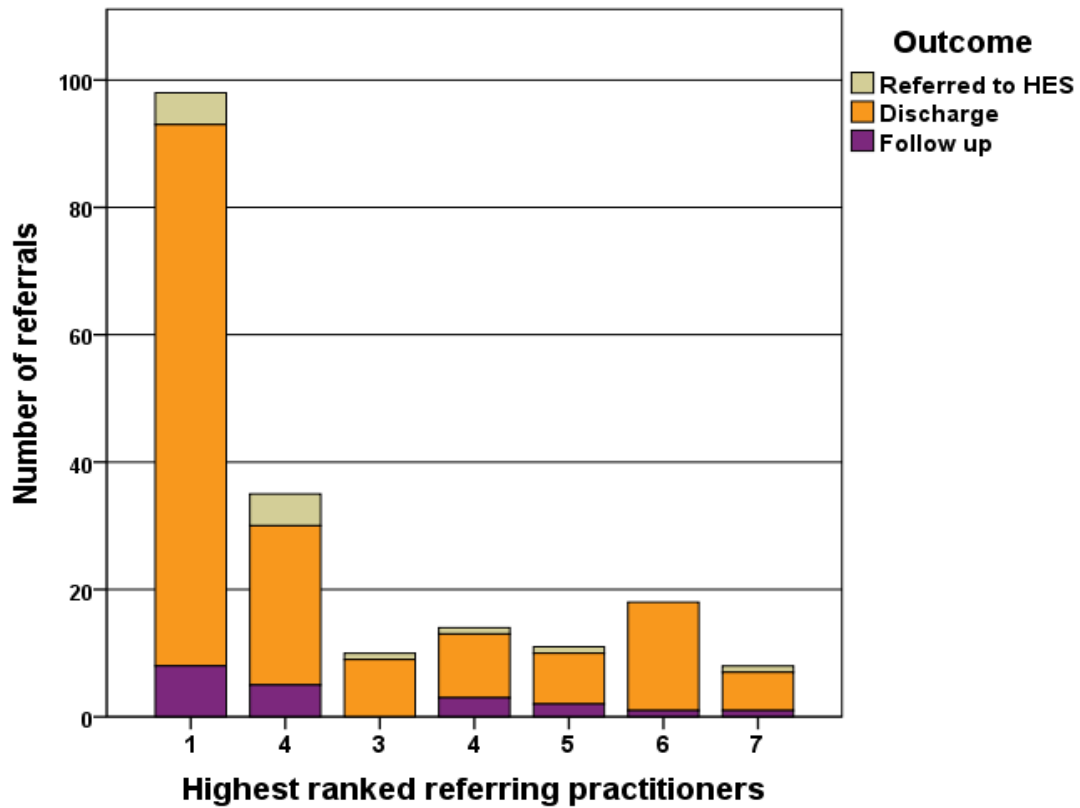


Figure 3. Outcome following community assessment by the seven highest ranked referring practitioners (out of 158).

b) Online vignettes

In all cases, each mean vignette set score was lower when compared with the expert panel score giving a negative result. There was wide variation in set scores and VSC within all three groups (Table 1).

	Main group (31)			NQO (18)			PRO (11)		
	Set A	Set B	VSC	Set A	Set B	VSC	Set A	Set B	VSC
Mean	-92.4	-74.9	17.5	-92.4	-72.8	19.6	-89.4	-71.1	18.3
Standard Deviation	19.7	20.9	14.1	22.8	25.3	19.9	20.8	24.9	19.4

Table 1. Mean and standard deviation for Vignette Sets A, B and VSC (Vignette Score Change) by group. NQO = newly-qualified optometrist, PRO = pre-registration optometrist

No significant correlation was found ($r = 0.17$, $p = 0.37$) between the VSC and number of CET points obtained in six-months (Figure 4). As the study was conducted towards the end of the GOC CET cycle, participants provided their MyGOC CET points record for three years. Comparison of these data from the main group with an anonymised GOC sample identified significantly higher numbers of CET points ($U = 425$, $p = 0.008$) and peer discussions ($U = 406$, $p = 0.003$) in the main group. Seven optometrists in the main group had speciality CET points compared with two optometrists in the GOC sample. Peer discussion had been introduced by the GOC into this CET cycle for the first time, but no statistically significant correlation was found between the VSC and the number of peer discussion sessions undertaken ($r = 0.24$, $p = 0.90$).

The referral letter audit identified evidence of comprehensive content and use of tests such as applanation tonometry, ocular coherence tomography, and the Humphrey visual field analyser in the main group.

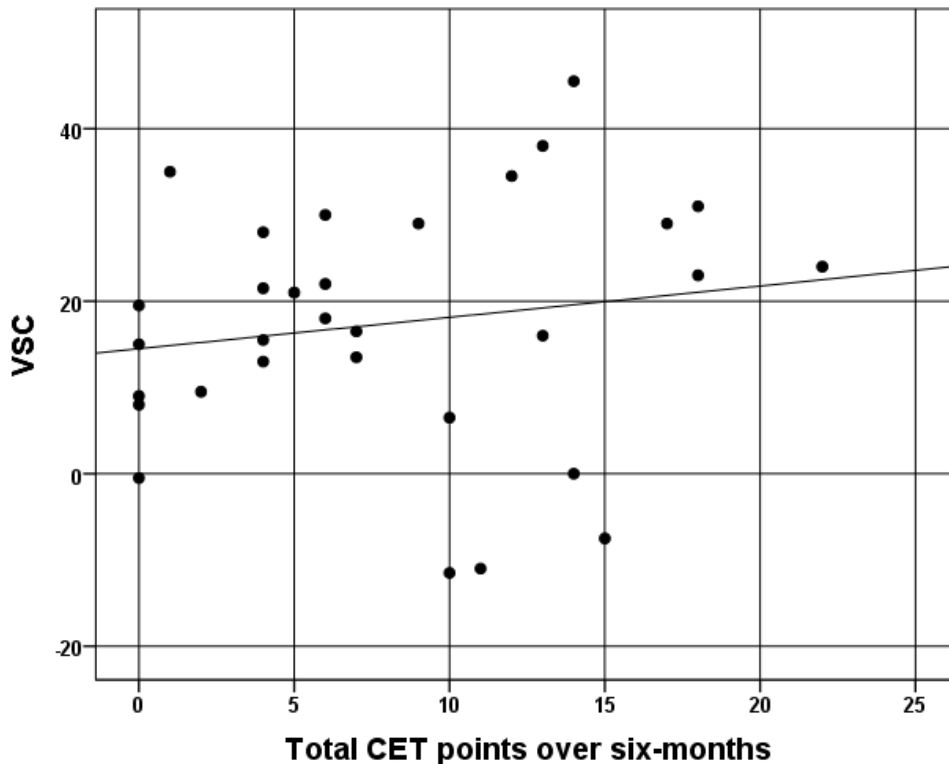


Figure 4. VSC (Vignette Score Change) plotted against CET points achieved over a six-month period for the main group.

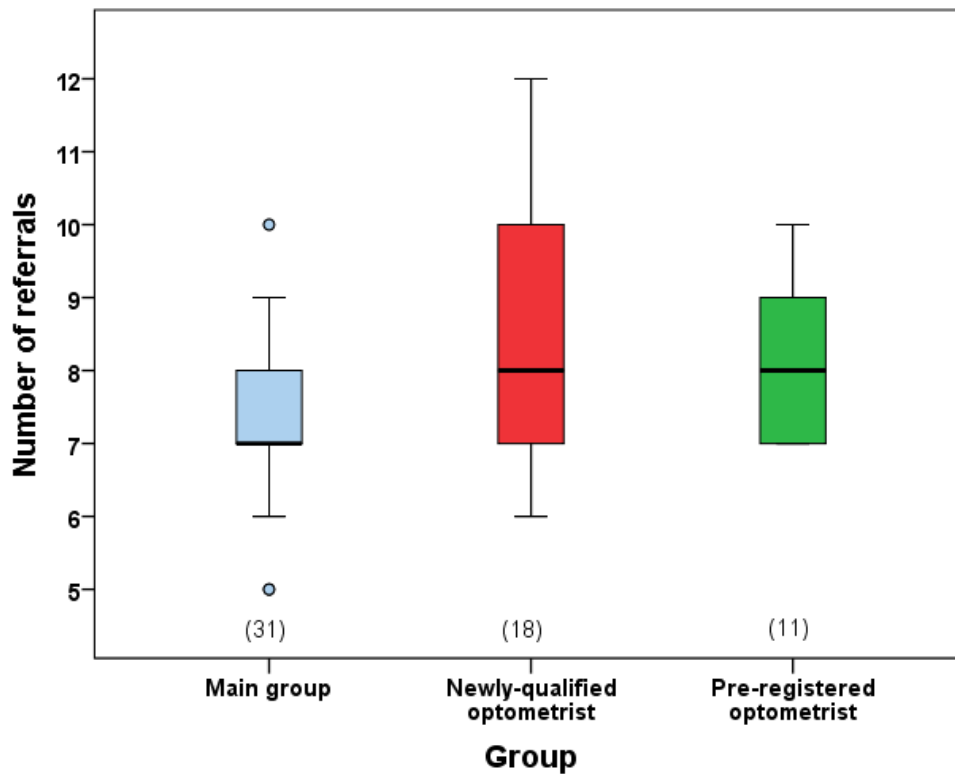


Figure 5. Number of referrals made by each group of optometrists from all twenty vignettes.

The vignettes provided comprehensive data on the number of referrals made and how optometrists would refer a range of presentations. Only the difference in the number of referrals made between the main group and NQO group was significant (Dunn's test, $p = 0.004$) with the NQO group making more referrals than the main group. More outliers (upper quartile) were observed in the NQO group compared with the main group and PROs (Figure 5).

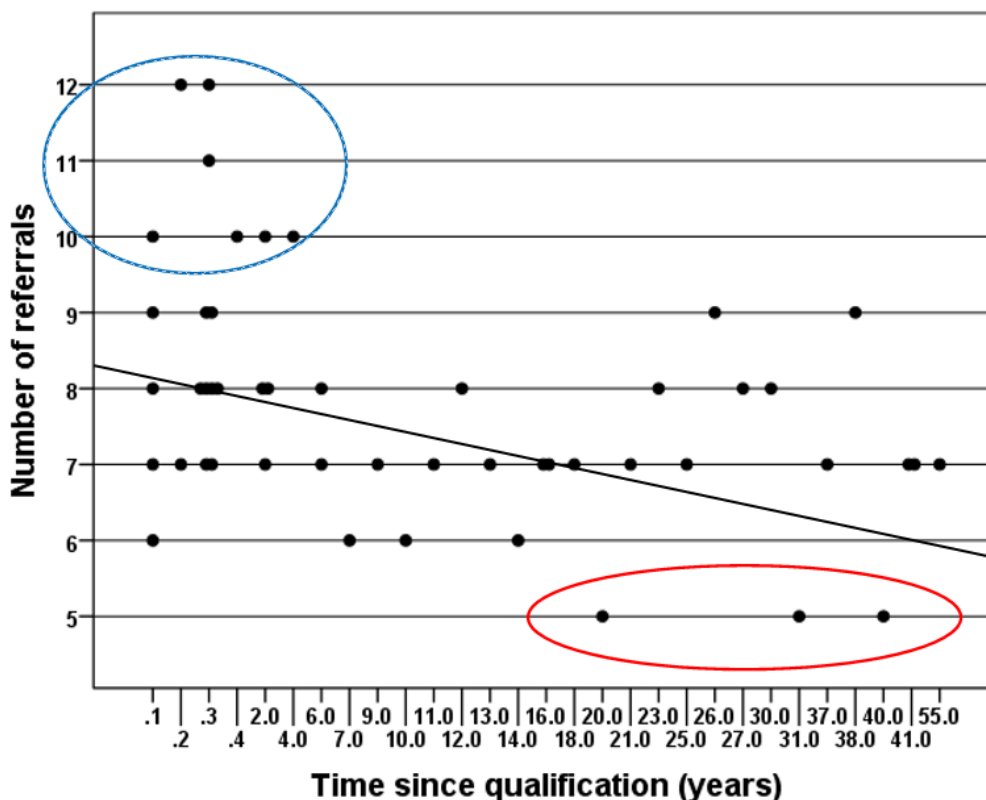


Figure 6. Number of referrals plotted against time since qualification (years) for main and NQO (newly-qualified optometrist) groups (Note, the scale used for the ‘Time since qualification’ is non-uniform to facilitate inclusion of the main group and the NQOs on the same graph; see text for explanation of coloured ellipses).

A Spearman’s rank-order correlation was used for this analysis as the variables were not normally distributed. There was a significant negative correlation between the number of referral decisions made by each practitioner and their time since qualification ($r_s = -0.39$, $p = 0.005$). When decisions were compared, a greater number in the NQO group plus a few practitioners who had been in practice for periods of up to two years (outlined by the blue ellipse) would have referred in ten or more vignettes compared with half this number in some of those who had been in practice for longer (Figure 6). The x axis scale of time since qualification in Figure 6 is non-uniform to enable identification of the NQO group. Three participants (outlined by the red ellipse), two of whom had a qualification in independent prescribing, would have referred in only five vignettes. Six of the twenty vignettes were designed and assessed by the expert panel for an outcome of definite referral. Non-referral by these three participants in one of the six referral cases was attributed to the same decision to manage a patient with early Fuchs dystrophy.

The number of sight tests conducted in a day by the PRO group was, as expected, significantly fewer (Dunn's test, $p = < 0.0005$) than in the other two groups (PRO mean rank 11.50, main 33.37, NQO = 37.17). Although the number of sight tests per day in the NQO group was slightly higher than the main group, this was not significant (Dunn's test, $p = 0.46$).

Discussion

Audit

One third of referrals in the audit could not be attributed to a practitioner code. This proportion was similar to that reported in a study by Lash¹⁸ but higher than reported by Davey *et al.* (17.7%).² The explanation for this high proportion in the current study was reported by referral management staff to be that practitioners were either not recording their name or just adding an illegible signature on a handwritten GOS18 (GOS General Ophthalmic Service) referral form. A practice code was missing in 5.6% of cases. High numbers of referrals without adequate source information do not encourage a reply from ophthalmologists.

Two optometrists identified as newly-qualified from the practitioner code (out of 158) generated 12.5% of all referrals. The absence of audit of referral outcome boxes on NHS sight test forms (GOS1) has hindered the identification of referral outliers. A lack of financial disincentives for referring low-risk cases has been highlighted by previous researchers.^{3,19,20} During the period 2007-2011, there were cataract refinement and glaucoma repeat measures schemes in place as well as an initiative in the audit area whereby outlier NQOs with high referral rates were offered support and the opportunity to gain clinical experience and feedback by observing in ophthalmology clinics. As a result, their decision-making and referral quality improved. However, the natural turnover of employed and locum optometrists resulted in new NQOs with similar high referral patterns becoming employed in the area to replace those whose referrals had been moderated.

High community discharge rates suggest that strategies for targeted additional training and support may be necessary for referrals for low-risk suspect glaucoma/ocular hypertension (OHT) and low-risk fundus-related conditions. A

request for a second opinion could be considered a valid reason for referral in some instances where there is no funding to examine the patient again, but many glaucoma referrals were made on a single suspect result and there were referrals for early dry or pigmented macular changes where no treatment was indicated. Recently, updated NICE glaucoma guidance has included recommendations that a decision to refer should not be based solely on IOP measurement using NCT and to recheck suspect visual fields and IOPs (using Goldmann-type applanation tonometry (GAT)) prior to referral.²¹ NICE highlights that these recommendations are separate from the NHS sight test.

Similarly, NICE age-related macular degeneration (AMD) guidance has made a recommendation not to refer people with asymptomatic early AMD to the HES for further diagnostic tests.²² However, the NHS sight test in England only provides funding for a single appointment, the main purpose of which is to carry out a refraction relating to the supply of spectacles and does not fund additional review appointments to refine referral decisions. Primary eye care schemes²³ additional to the NHS sight test are not universal but are commissioned locally by some Clinical Commissioning Groups (CCGs). Optical practices are not mandated to participate in these schemes. This can lead to variation in the service provision offered and the subsequent referral outcome by practitioner, practice and by area.

The audit only considered false-positives and true-positives. Specifically, the audit cannot reveal patients who should have been referred but were not. This can present an unrepresentative view of primary optometric practice but often provides a similar perspective to that of ophthalmologists who receive these referrals.

Vignettes

Despite the lack of evidence for a relationship between CET points and clinical decision-making and referral practice, each vignette generated a comprehensive data set and highlighted variation between individual practitioners within each group and between groups. Responses aligned with previous observations of *'substantial differences between different practitioners in the duration and depth of*

*their clinical investigations'*²⁴ and '*... there is no such thing as a 'standard sight test'*'²⁵

For example, a vignette for suspect ocular hypertension highlighted the importance of repeating suspect tests. In another vignette, lid ptosis affected the left visual field with a high number of false-positives and fixation losses affecting accuracy. The vignette revealed that when the lid was taped up, the visual field was normal. Repeat measurements by GAT found both IOPs below 21mmHg. Most practitioners reported they would have managed the patient, while the proportion of those who would refer was greatest in the NQO group (main group = 90% self-managed, NQO = 68%, PRO = 92%).

Another vignette involved the management of an existing patient presenting for an eye examination with a history of a floater and flashes, onset six weeks and with no flashes noticed for three weeks. Most practitioners 'examined' the patient using dilated slit-lamp binocular indirect ophthalmoscopy (main group = 94%, NQO = 96%, PRO = 100%). However, had this patient 'presented' without a booked appointment more NQOs reported that they would refer direct to the HES without examination (main group = 13% referred, NQO = 39%, PRO = 23%). There could be various explanations for this in real life, including lack of time in a busy clinic, not being accredited for a Minor Eye Conditions Scheme (MECS), the inadequate scope of the GOS or an unwillingness of the patient to pay for a private examination. However, the additional question only asked 'Had a new patient come in as before and you were booked up for the next appointment slot, would you:

- 1) Refer to HES without examination?
- 2) Agree to see patient at the end of the morning clinic (either privately or under MECS)? (main group = 87%, NQO = 57%, PRO = 71%)
- 3) Tell the patient to book in to see you in next available slot on another day? (main group 0%, NQO = 4%, PRO = 6%).

Referral decisions appeared more likely to occur where there were discretionary indications or where there was clinical uncertainty regarding how best to manage the condition. This was demonstrated in a vignette where a patient with mild

cataract with new refractive correction achieved an improvement in visual acuity (VA) R 6/9+ L 6/7.5+ and was happy with the result. Despite this, a greater number in the NQO group recommended referral (main group = 10% referred, NQO = 28%, PRO = 0%). Another patient with mild cataract, pleased with the refractive improvement of visual acuities to R 6/12+ L 6/9-, was undecided about surgery after an explanation of risks and benefits. When asked for advice, most of the main and PRO group would not have referred but more than half of the NQOs recommended referral (main group = 26% referred, NQO = 56%, PRO = 18%). Not all cataract patients who are referred to the HES will proceed to surgery, and the alignment of shared referral and treatment thresholds across primary and hospital care might reduce unnecessary referrals. However, it is acknowledged that VA can be a poor measure of visual disability from cataract and there should be exception criteria, such as symptoms of severe glare from car headlights.

The vignettes had undergone piloting but had not been previously validated and therefore, their sensitivity was not determined. There is a possibility that a few of the cataract referral decisions were being limited by experience of CCG imposed VA thresholds. If so, it would be unfair to criticise if variation of outcome simply reflected a variation in practitioners' local protocols or procedures. However, most of the variation related to over-referral with better VAs, against typical restrictions of VA equal to or worse than 6/12. NICE guidance for cataracts in adults has now recommended that access to surgery should not be restricted based on VA.²⁶

There was duplication of optometric referrals for diabetic retinopathy when patients had already attended diabetic eye screening programmes. When presented with a patient with mild non-sight threatening diabetic retinopathy (retinopathy grading: R1M0), some practitioners still referred to the HES (main group = 13% referred, NQO = 32%, PRO = 9%). Information for the optometrist is essential to avoid referral and unnecessary costs where screening has already taken place.

Most variation occurred in the 'grey' vignettes and also in vignette scores within groups and between groups. Very few in each group achieved a maximum vignette score in line with the expert panel assessment and this resulted in negative set scores. For some, a binary decision 'to refer' or 'not to refer' might have been an

overriding factor, and once the referral decision has been made, there is no point or incentive in proceeding any further and conducting more tests.^{19,20}

Despite small sample sizes, the main trend observed throughout the individual vignettes was the variation between the NQOs and the other two groups. Some NQOs appeared more risk-averse. When faced with uncertainty or extra presentations outside their routine work, some NQOs would have referred or directed the patient elsewhere without examining them. This could suggest a lack of confidence, lack of time to conduct the examination, or acceding to pressure from employers or practice managers. Our finding in this regard is consistent with the results of a recently published survey of perceptions of UK optical education, which noted that 'Many employers had experience of newly-qualified practitioners making unnecessary referrals'.²⁷ The survey revealed that at the end of their pre-registration year, over one quarter of optometrists feel that their clinical experience to date has not been adequate and this was the case for over a third of locums. Over a quarter of PROs do not feel supported by their supervisor and one in five NQOs do not feel prepared to practise autonomously and independently or prepared to make confident decisions.

PRO referral decisions are moderated under the supervision of an experienced optometrist with additional supervisor training. The supervising optometrist retains accountability. In the vignettes, PROs referred more appropriately than NQOs (Figure 5), suggesting a lower referral decision threshold for some once they are qualified. Once qualified, advice and support might not be readily available and, in this study, being newly-qualified appears to be linked to a significant increase in the number of sight tests undertaken in a day. This may well lead to circumstances where some NQOs feel under pressure to make a quick decision, and consequently refer more readily.

This study supports previous findings of variation by referral source. Theodossiades & Murdoch found that two optometrists in their sample were responsible for referring more than ten people each whilst the majority (20) had referred only one or two people.⁸ Similarly, Davey *et al.* found that one optometrist had made 19 referrals when the median number in the audit was two.³

Unwarranted variation in referral patterns by a few practitioners appears to have continued without consequence, support or incentive to change. In some CCGs in England, community ophthalmology services have been commissioned to refine low-risk referrals from primary care, rather than incentivise optometrists through appropriate funding to provide a more comprehensive primary eye examination (and supplementary examination when clinically required) as commissioned in the Scottish GOS. Over the last ten years, new ophthalmology outpatient attendances in England have increased by 32% whereas in Scotland there has only been a 13% increase.²⁸ The Royal College of Ophthalmologists has reported capacity and demand issues in recent years.²⁹ Yet, official signs of the pressures building within the HES were identified in 2009 when the National Patient Safety Agency issued a rapid response report regarding hospital patients losing vision as result of delayed glaucoma review appointments.³⁰

A decision to refer by the optometrist has implications for both the NHS and the patient. The tariff for a first ophthalmology outpatient attendance is £139 (single professional) or £148 (multi-professional).³¹ The patient may need to take time off work and pay for transport to and from the HES clinic; and the referral may cause anxiety for the patient while waiting to be seen. This is accepted when making an 'appropriate' referral but set against current NHS financial and HES capacity challenges, making inappropriate referrals is wasteful for the NHS and leads to increased delays for patients referred for more serious conditions and those at-risk patients receiving follow-up appointments with sight-threatening conditions.

To reduce inappropriate referrals, NQOs in England should be encouraged to continue their professional and clinical skills development by participating in the delivery of additional primary eye care schemes such as glaucoma repeat measures and cataract pre-assessment as optometrists were found to be 2.7 times less likely to refer inappropriately where these were commissioned.³ Our preliminary finding that practitioners with an IP qualification were less likely to refer deserves further investigation. In Scotland, one of NHS Education for Scotland's (NES) optometry themes is to develop an excellent workforce and highlights pre-registration support and mentoring of newly-qualified practitioners.³² A strategic

approach to the educational development of the primary eye workforce has also seen a significant increase in postgraduate education and nearly one third of the optometric profession in Scotland are either qualified, or training to be independent prescribers.²⁸

Replies to referral letters can support the on-going management of patients within the community and are important to improve the quality and appropriateness of referrals.³³ Audits have shown that only a small proportion of optometrist referrals result in a reply (directly or copied) to the referring optometrist.^{34,35} As healthcare professionals, optometrists take full responsibility for their referral decisions and, as such, have a legitimate right to be concerned for their patients' welfare and to have their concerns addressed in a reply. This provides assurance that the referral has been dealt with appropriately and that the patient's needs have been met.

Strengths and limitations of the research

a) Audit.

The anonymised triage data which was audited related to a single commissioning area in England, and for an earlier period (2007-2011) than the online vignette study which was UK-wide. This limits the generalisability of the referral audit. In particular, the high proportion of referrals that did not include the practitioner's name may not be replicated elsewhere, especially in areas that use software to generate letters. The triage audit focussed on false-positive referrals after community review, however, determining the reasons for under-referral (false negatives) can be just as important as over-referral. The audit was not able to make any assessment regarding false-negative cases.

The triage data did not include referral activity from the direct cataract referral pathway (average number over the three months for the five-year period = 115), emergency same day and suspect wet AMD pathway referrals, and therefore the total number of referrals in the area for the period could be not determined.

b) Vignettes

An important strength of the online vignettes was that they were carefully designed to avoid prompting of answers. Vignettes have been found to over-estimate clinical performance.^{36,37} Yet, in each vignette set in this study, the scores were found to be lower compared with the expert panel score resulting in a negative result and this provided useful comparisons between different groups of practitioners.

The main limitation of the online vignette study was the low number of participants. This made the study underpowered and increased the risk of one or two outliers introducing bias.

The number of CET points gained may not include all Continuing Professional Development (CPD) undertaken by the optometrist. This CPD data was requested but none of the participants responded positively. We acknowledge that the number of CET points gained may not be an ideal intervention, but it does have the virtue of being a realistic measure of what happens for optometrists in primary optometric practice and does have face validity.

Participants in the main group were an atypical cross-section of the profession in terms of their CET. The time since qualification for each participant in the main group was two years and above and is shown in Figure 6. In common with other studies assessing clinical performance,^{38, 39} the risk of attracting optometrists more confident in their skills was recognised at the outset as a possible limitation of this study. Shah *et al.* highlighted that clinical vignettes had a selection bias if the participation rate was low and a Hawthorne effect is considered inevitable.⁴⁰

Although the online study design was intended to attract optometrists UK-wide, there was selection bias in the main group with a high proportion of independent optometrists working in England with higher levels of CET compared to the GOC random sample. Despite the efforts to achieve a large sample size through repeated promotion across the UK¹⁷, selection-bias and Hawthorne effect factors could not be avoided.

Most practitioners worked in England (main group = 87.5%, NQO = 89%, PRO = 74%). However, this distribution reflects the fact that the population of England is 84.1% of the population of the UK.⁴¹ Most of the main group worked in independent practice (75%), while all NQOs and 73% of PROs worked in corporate practice. Despite the self-selection bias and Hawthorne effect, it was noteworthy that some degree of underperformance and variation in scores applied across each group.

All but one of the practitioners in the referral letter audit worked in independent practice and all had been qualified for ten years or more.

Conclusions

Research into referral decision-making is challenging. Those, who are less confident in their skills and expertise, may avoid involvement in the research because of a reluctance to have their performance assessed and the possibility of identifying poor performance. The results suggest that unwarranted variation in referral decision-making may exist within optometry in the UK. Gaining CET points does not appear to influence clinical decision-making or referral practice, although it is acknowledged that this part of the study was underpowered. The literature highlights optometrists as a source of false-positive referrals but finds that those who are accredited for primary eye care schemes are less likely to refer inappropriately. This study suggests that some NQOs may be responsible for a greater proportion of false-positive referrals than other optometrists. At a time when clinical confidence and experience are still developing, an increased workload on qualification might lead to pressure to make quick and more risk-averse decisions, and consequently refer more readily.

Clinical audit should be the first step in gaining a greater understanding of the workforce and referral practices. A referral benchmarking tool for comparing own referral practice with anonymised peers could be helpful. Only then can strategies for targeted support be put in place to modify referral practice. A triage process is one approach to improving the appropriateness of referrals reaching the HES, but triage for all referrals should not be necessary once the assessment of quality from

a practice has been determined. Indeed, the introduction of a community referral triage process in many areas could be seen as introducing a new tier, rather than trying to address an underlying problem which appears, from our data, to be a small minority of practitioners who over-refer. If similar findings to this study were found from other audits, then an argument could be made for the adoption of a targeted intervention strategy to improve optometric referrals. At the most fundamental level, if a simple reply to the referring optometrist was the norm rather than the exception then it seems likely that this feedback loop would play an important role in raising standards. To receive a reply, legible practitioner and practice information are, of course, essential data to be included in the referral letter. Additionally, the Royal College of General Practitioners has recommended approaches to improving referrals to the secondary sector⁴² and we believe that similar strategies are warranted in optometry.

To support NQOs, as well as gaining early accreditation for primary eye care schemes, mentoring and support should be considered for up to two years post-qualification. This could be in the form of a portfolio approach and targeted GOC approved CET specifically designed for NQOs which could take the form of referral peer discussion. Indeed, support could apply to any optometrist identified through audit and could equally apply to those who appear to be under-referring. Outlier NQOs should be able to observe in a HES clinic as this provides an opportunity to discuss their referral thresholds directly with ophthalmologists. HES replies to referral letters are vital for all NQOs to develop their clinical confidence and also for more experienced optometrists to provide continuity of care.

Acknowledgements: This study was supported by grants from the Central Optical Fund, and Bexley, Bromley, and Greenwich Local Optical Committee. Beju Shah provided the technical expertise required for the development of the website. We would like to thank the optometrist and ophthalmologist members of the expert panel for their time and clinical expertise, and those volunteer participants who took part in the pilot study and provided valuable feedback. Also, we are grateful to the College of Optometrists, the General Optical Council, the optical company who

supported the newly-qualified section, and the referral management service who provided the anonymised triage data.

References

1. Bowling B, Chen SD & Salmon JF. Outcomes of referrals by community optometrists to a hospital glaucoma service. *Br J Ophthalmol* 2005; 89: 1102–1104.
2. Davey CJ, Green C & Elliott DB. Assessment of referrals to the hospital eye service by optometrists and GP's in Bradford and Airedale. *Ophthalmic Physiol Opt* 2011; 31: 23–28.
3. Davey CJ, Scally AJ, Green C, Mitchell ES & Elliott DB. Factors influencing accuracy of referral and the likelihood of false positive referral by optometrists in Bradford, United Kingdom. *Journal of Optometry* 2016; 9:158–165.
4. Khan S, Clarke J & Kotecha A. Comparison of optometrist glaucoma referrals against published guidelines. *Ophthalmic Physiol Opt* 2012; 32: 472–477.
5. Bowling B, Chen SDM & Salmon JF. Outcomes of referrals by community optometrists to a hospital glaucoma service. *British Journal of Ophthalmology* 2005; 89: 1102–4.
6. Salmon NJ, Terry H, Farmery A & Salmon JF. An analysis of patients discharged from a hospital-based glaucoma case-finding clinic over a 3-year period. *Ophthalmic Physiol Opt* 2007; 27: 399–403.
7. Davey CJ, Harley C & Elliott DB. Levels of State and Trait Anxiety in Patients Referred to Ophthalmology by Primary Care Clinicians: A Cross Sectional Study. *PLoS ONE* 2013; 8(6).
8. Theodossiades J & Murdoch I. Positive predictive value of optometrist-initiated referrals for glaucoma. *Ophthalmic Physiol Opt* 1999; 19: 62–7.
9. Tuck MW & Crick RP. Efficiency of referral for suspected glaucoma. *British Medical Journal* 1991; 302: 998–1000.
10. Imison C & Naylor C. Referral management - Lessons for success. The King's Fund London UK 2010, <https://www.kingsfund.org.uk/publications/referral-management>, accessed 01/01/17.
11. Alderwick H, Robertson R, Appleby J, Dunn P & Maguire D. Better value in the NHS - The role of changes in clinical practice. The Kings Fund London UK 2015, <https://www.kingsfund.org.uk/publications/better-value-nhs>,

accessed 01/01/17.

12. Introduction to CET. General Optical Council, <https://www.optical.org/en/Education/CET/index.cfm>, accessed 17/11/17.
13. Bullock A, Barnes E, Ryan B & Sheen N. Case-based discussion supporting learning and practice in optometry. *Ophthalmic Physiol Opt* 2014; 34: 614–621.
14. Myint J, Edgar D, Murdoch I & Lawrenson J. The impact of postgraduate training on UK optometrists' clinical decision-making in glaucoma. *Ophthalmic Physiol Opt* 2014; 34: 376–84.
15. Guidance for Professional Practice. College of Optometrists 2017, <https://guidance.college-optometrists.org/home/>, accessed 17/12/17.
16. Faucher, C., Tardif, J. & Chamberland, M., 2012. Optometrists' Clinical Reasoning Made Explicit. *Optometry and Vision Science* 2012; 89: 1774–1784.
17. Parkins, DJ. An investigation into the decision-making of primary care optometrists and whether contemporary continuing education and training (CET) improves referral practice? (Thesis). London South Bank University 2018.
18. Lash SC. Assessment of information included on the GOS 18 referral form used by optometrists. *Ophthalmic Physiol Opt* 2003; 23: 21–23.
19. Pooley J & Frost E. Optometrists' referrals to the Hospital Eye Service. *Ophthalmic Physiol Opt* 1999; 19(S1001), S16–S24.
20. Pooley J. Referrals from the community to the hospital eye service. (Thesis). City, University of London 1996.
21. Glaucoma : diagnosis and management [NG81]. NICE Guidance 2017, <https://www.nice.org.uk/guidance/ng81/chapter/Recommendations>, accessed 17/11/17.
22. Age-related-macular-degeneration [NG82]. NICE Guidance 2018, <https://www.nice.org.uk/guidance/ng82/chapter/Recommendations#classifying-age-related-macular-degeneration>, accessed 01/02/18.
23. Primary eye care framework. Clinical Council for Eye Health Commissioning 2018, <http://www.ccehc.org.uk>, accessed 17/06/18.
24. Shah R, Edgar DF, Spry PG *et al*. Glaucoma detection: the content of optometric eye examinations for a presbyopic patient of African racial descent. *British Journal of Ophthalmology* 2009; 93: 492–496.
25. Shah R, Edgar DF, Rabbetts R, Harle DE & Evans BJW. Standardized

Patient Methodology to Assess Refractive Error Reproducibility. *Optometry and Vision Science* 2009; 86: 517-528.

26. Cataracts in adults: management [NG77]. NICE Guidance 2018, <https://www.nice.org.uk/guidance/ng77/chapter/Recommendations>, accessed 17/11/17.
27. Thurman M. Perceptions of UK optical education – final report – The General Optical Council. Enventure research. May 2018, http://www.optical.org/filemanager/root/site_assets/education/education_strategic_review/supplementary_reading/perceptions_of_uk_optical_education_-_june_2018.pdf, accessed 25/06/18.
28. Community Eyecare Services Review. Scottish Government 2017, <http://www.gov.scot/Resource/0051/00516810.pdf>, accessed 30/04/17.
29. Increasing demand on hospital eye services risks patients losing vision. RCOphth 2016, <https://www.rcophth.ac.uk/2016/03/increasing-demand-on-hospital-eye-services-risks-patients-losing-vision>, accessed 10/10/2017.
30. Preventing delay to follow-up for patients with glaucoma. National Patient Safety Agency 2009, <http://www.nrls.npsa.nhs.uk/resources/?entryid45=61908>, accessed 10/02/2018.
31. National tariff payment system 2017/18 and 2018/19. NHS Improvement 2017, <https://improvement.nhs.uk/resources/national-tariff-1719/#h2-tariff-documents>, accessed 14/06/2018.
32. NHS Education for Scotland - Optometry Strategy 2015-2020, <http://www.nes.scot.nhs.uk/education-and-training/by-discipline/optometry/about-nes-optometry/strategy.aspx>, accessed 10/10/2017.
33. Sharing patient information between healthcare professionals – a joint statement from The Royal College of Ophthalmologists and College of Optometrists. RCOphth 2015, <https://www.rcophth.ac.uk/2015/03/sharing-patient-information-between-healthcare-professionals-a-joint-statement-from-the-royal-college-of-ophthalmologists-and-college-of-optometrists>, accessed 03/03/17.
34. Whittaker KW, Ikram K, Anderson DF, Keil A and Luff AJ. Non-communication between ophthalmologists and optometrists. *Journal of the Royal Society of Medicine*, 1999; 92: 247–248.
35. Evans BJW, Harle DE & Cocco B. Optometric referrals: towards a two way flow of information? *British Journal of Ophthalmology* 2005; 89: 1663.
36. Peabody JW, Luck J, Glassman P, Dresslhaus T & Lee M. Comparison of

- vignettes, standardized patients, and chart abstraction: a prospective validation study of 3 methods for measuring quality. *JAMA* 2000; 283: 1715–22.
37. Peabody JW, Luck J, Glassman P *et al.* Measuring the quality of physician practice by using clinical vignettes: a prospective validation study. *Ann Intern Med* 2004; 141: 771–780.
 38. Theodossiades J, Myint J, Murdoch IE, Edgar DF & Lawrenson JG. Does optometrists' self-reported practice in glaucoma detection predict actual practice as determined by standardised patients? *Ophthalmic Physiol Opt*, 2012; 32: 234–241.
 39. Myint J, Edgar DF, Kotecha A, Murdoch IE & Lawrenson JG. A national survey of diagnostic tests reported by UK community optometrists for the detection of chronic open angle glaucoma. *Ophthalmic Physiol Opt* 2011; 31: 353–359.
 40. Shah R, Edgar DF & Evans BJW. Measuring clinical practice. *Ophthalmic Physiol Opt* 2007; 27: 113–125.
 41. Population Estimates for UK, England and Wales, Scotland and Northern Ireland. Office for National Statistics, <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwales/scotlandandnorthernireland>, accessed 28/03/18.
 42. Quality patient referrals: Right service, right time. Royal College of General Practitioners 2018, <http://www.rcgp.org.uk/policy/rcgp-policy-areas/referral-management.aspx>, accessed 22/04/18.