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## SIGN 144 • Glaucoma referral and safe discharge

*A national clinical guideline*

*March 2015*

## KEY TO EVIDENCE STATEMENTS AND RECOMMENDATIONS

### LEVELS OF EVIDENCE

1 <sup>++</sup>	High-quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias
1 <sup>+</sup>	Well-conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias
1 <sup>-</sup>	Meta-analyses, systematic reviews, or RCTs with a high risk of bias
2 <sup>++</sup>	High-quality systematic reviews of case-control or cohort studies High-quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal
2 <sup>+</sup>	Well-conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal
2 <sup>-</sup>	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal
3	Non-analytic studies, eg case reports, case series
4	Expert opinion

### RECOMMENDATIONS

Some recommendations can be made with more certainty than others. The wording used in the recommendations in this guideline denotes the certainty with which the recommendation is made (the 'strength' of the recommendation).

The 'strength' of a recommendation takes into account the quality (level) of the evidence. Although higher-quality evidence is more likely to be associated with strong recommendations than lower-quality evidence, a particular level of quality does not automatically lead to a particular strength of recommendation.

Other factors that are taken into account when forming recommendations include: relevance to the NHS in Scotland; applicability of published evidence to the target population; consistency of the body of evidence, and the balance of benefits and harms of the options.

**R** For '**strong**' recommendations on interventions that 'should' be used, the guideline development group is confident that, for the vast majority of people, the intervention (or interventions) will do more good than harm.

**R** For '**conditional**' recommendations on interventions that should be 'considered', the guideline development group is confident that the intervention will do more good than harm for most patients. The choice of intervention is therefore more likely to vary depending on a person's values and preferences, and so the healthcare professional should spend more time discussing the options with the patient.

### GOOD-PRACTICE POINTS

✓ Recommended best practice based on the clinical experience of the guideline development group



NHS Evidence has accredited the process used by **Scottish Intercollegiate Guidelines Network** to produce guidelines. Accreditation is applicable to guidance produced using the processes described in SIGN 50: a guideline developer's handbook, 2008 edition ([www.sign.ac.uk/guidelines/fulltext/50/index.html](http://www.sign.ac.uk/guidelines/fulltext/50/index.html)). More information on accreditation can be viewed at [www.evidence.nhs.uk](http://www.evidence.nhs.uk)

Healthcare Improvement Scotland (HIS) is committed to equality and diversity and assesses all its publications for likely impact on the six equality groups defined by age, disability, gender, race, religion/belief and sexual orientation.

SIGN guidelines are produced using a standard methodology that has been **equality impact assessed** to ensure that these equality aims are addressed in every guideline. This methodology is set out in the current version of SIGN 50, our guideline manual, which can be found at [www.sign.ac.uk/guidelines/fulltext/50/index.html](http://www.sign.ac.uk/guidelines/fulltext/50/index.html). The EQIA assessment of the manual can be seen at [www.sign.ac.uk/pdf/sign50eqia.pdf](http://www.sign.ac.uk/pdf/sign50eqia.pdf). The full report in paper form and/or alternative format is available on request from the Healthcare Improvement Scotland Equality and Diversity Officer.

Every care is taken to ensure that this publication is correct in every detail at the time of publication. However, in the event of errors or omissions corrections will be published in the web version of this document, which is the definitive version at all times. This version can be found on our web site [www.sign.ac.uk](http://www.sign.ac.uk).



Scottish Intercollegiate Guidelines Network

# **Glaucoma referral and safe discharge**

A national clinical guideline



March 2015

**Scottish Intercollegiate Guidelines Network  
Gyle Square, 1 South Gyle Crescent  
Edinburgh EH12 9EB**

**[www.sign.ac.uk](http://www.sign.ac.uk)**

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# 1 Introduction

## 1.1 THE NEED FOR A GUIDELINE

Glaucoma is an eye disease characterised by a progressive optic neuropathy and associated visual field loss (VFL). Glaucoma is the leading cause of irreversible blindness worldwide.<sup>1</sup> In the UK glaucoma is the second most common cause of visual impairment.<sup>2</sup>

Glaucoma can be classified anatomically according to the width of the anterior chamber angle in the eye, and is either a primary condition or secondary to another systemic or ocular condition.<sup>3</sup>

The incidence of glaucoma in the UK increases with age and glaucoma accounts for up to 20% of referrals to secondary-eye-care services, the vast majority of which come via community optometrists. Since glaucoma is associated with advancing age, the number of patients requiring management of the condition is rising as life expectancy increases.<sup>4</sup>

Early identification and referral of patients with ophthalmic pathology, and prompt secondary-care response facilitates timely management with the aim of limiting visual disability.<sup>3,5,6</sup>

In one study in England around a third of referrals from optometrists without special interest in glaucoma resulted in discharge at first visit.<sup>4</sup> The Scottish General Ophthalmic Services (GOS) arrangements are unique to Scotland and were implemented in 2006 to facilitate identification of ophthalmic pathology at the earliest opportunity.<sup>7</sup> The arrangements can be found in Annex 1. The accuracy of the referral of patients with suspected glaucoma from the community to secondary-eye-care services has improved since introduction of the GOS although there are continuing issues around variation in practice.<sup>8</sup>

The current Scottish GOS arrangements offer a consistently wider range of clinical tests than are available elsewhere in the UK. They mandate glaucoma-detection strategies but do not incorporate guidance on which patient groups require referral from primary to secondary care, and this may result in variation in referral practice. Additionally, there is currently no guidance on which patient groups can be safely monitored in the community or discharged from secondary to primary care taking into account the existing clinical support services within the Scottish GOS arrangements.

## 1.2 REMIT OF THE GUIDELINE

### 1.2.1 OVERALL OBJECTIVES

This guideline provides recommendations based on current evidence for best practice in the primary-care assessment and referral of patients with suspected glaucoma of any subtype, from the community into secondary-eye-care services and the safe discharge of patients from secondary-eye-care services back into the community.

Recommendations are provided on the investigations required, the frequency of examinations and communication and notification of all the healthcare providers involved in the patient pathway.

The guideline also makes recommendations on identifying which patients can be safely followed up in the community maximising the potential of the existing GOS arrangements and the electronic interface between community optometry and NHS health boards through the Eyecare Integration Project.<sup>9</sup>

The key questions on which the guideline is based can be found in Annex 2.

The guideline excludes treatment of ocular hypertension (OHT) and glaucoma which is covered by National Institute for Health and Care Excellence (NICE) Clinical Guideline (CG) 85 Glaucoma: diagnosis and management of chronic open-angle glaucoma and ocular hypertension.<sup>10</sup>

### 1.2.2 TARGET USERS OF THE GUIDELINE

This guideline will be of particular interest to community optometrists, general practitioners and hospital-based healthcare professionals involved in glaucoma care, including ophthalmologists, optometrists, specialist nurses and orthoptists. It will also be of interest to patients and carers.

## 1.3 STATEMENT OF INTENT

This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

### 1.3.1 PATIENT VERSION

A patient version of this guideline is available from the SIGN website, [www.sign.ac.uk](http://www.sign.ac.uk)

### 1.3.2 PRESCRIBING OF LICENSED MEDICINES OUTWITH THEIR MARKETING AUTHORISATION

Recommendations within this guideline are based on the best clinical evidence. Some recommendations may be for medicines prescribed outwith the marketing authorisation (MA) also known as product licence. This is known as 'off label' use.

Medicines may be prescribed off label in the following circumstances:

- for an indication not specified within the marketing authorisation
- for administration via a different route
- for administration of a different dose
- for a different patient population.

An unlicensed medicine is a medicine which does not have MA for medicinal use in humans.

Generally 'off label' prescribing of medicines becomes necessary if the clinical need cannot be met by licensed medicines within the marketing authorisation. Such use should be supported by appropriate evidence and experience.<sup>11</sup>

"Prescribing medicines outside the conditions of their marketing authorisation alters (and probably increases) the prescribers' professional responsibility and potential liability."<sup>11</sup>

The General Medical Council (GMC) recommends that when prescribing a medicine 'off label', doctors should:

- be satisfied that such use would better serve the patient's needs than an authorised alternative (if one exists)
- be satisfied that there is sufficient evidence/experience of using the medicine to show its safety and efficacy, seeking the necessary information from appropriate sources
- record in the patient's clinical notes the medicine prescribed and, when not following common practice, the reasons for the choice
- take responsibility for prescribing the medicine and for overseeing the patient's care, including monitoring the effects of the medicine.



Non-medical prescribers should ensure that they are familiar with the legislative framework and their own professional prescribing standards.

Prior to any prescribing, the licensing status of a medication should be checked in the summary of product characteristics ([www.medicines.org.uk](http://www.medicines.org.uk)). The prescriber must be competent, operate within the professional code of ethics of their statutory bodies and the prescribing practices of their employers.<sup>12</sup>

### 1.3.3 ADDITIONAL ADVICE TO NHSSCOTLAND FROM HEALTHCARE IMPROVEMENT SCOTLAND AND THE SCOTTISH MEDICINES CONSORTIUM

Healthcare Improvement Scotland processes multiple technology appraisals (MTAs) for NHSScotland that have been produced by the National Institute for Health and Care Excellence (NICE) in England and Wales.

The Scottish Medicines Consortium (SMC) provides advice to NHS boards and their Area Drug and Therapeutics Committees about the status of all newly licensed medicines and any major new indications for established products.

No SMC advice relevant to this guideline was identified.

## 2 Key recommendations

The following recommendations and good-practice points were highlighted by the guideline development group as those that should be prioritised for implementation.

### 2.1 MEASUREMENT OF INTRAOCULAR PRESSURE

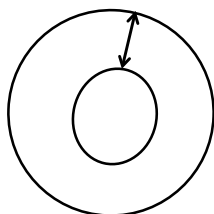
**R** For patients with ocular hypertension or suspected glaucoma a reliable baseline measure of intraocular pressure is required. A minimum of two intraocular pressure readings on a single occasion using the same tonometer is recommended. The type of tonometer and the time of measurement should be specified in any referral to secondary-eye-care services.

### 2.2 OPTIC DISC ASSESSMENT

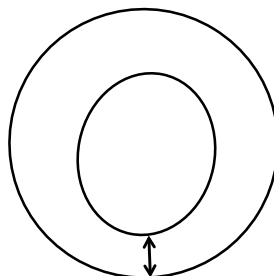
**R** The narrowest rim/disc ratio and disc size should be recorded and considered alongside additional indicators of glaucoma, such as optic disc nerve fibre layer haemorrhage and cup/disc ratio asymmetry, when assessing the need for referral to secondary-eye-care services.

✓ Patients with the following optic disc parameters should be considered for referral to secondary-eye-care services:

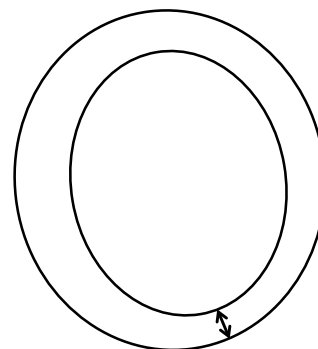
- small discs (<1.5 mm in diameter) where the narrowest rim/disc ratio is <0.3



- medium discs (1.5–2.0 mm in diameter) where the narrowest rim/disc ratio is <0.2



- large discs (>2.0 mm in diameter) where the narrowest rim/disc ratio is <0.1



These parameters correspond to Spaeth's disc damage likelihood scale stage 4 or greater.

### 2.3 VISUAL FIELD ASSESSMENT

✓ A minimum of two visual field tests with consistent findings is recommended before referral to secondary-eye-care services. One test may suffice if the result is unequivocal.

## 2.4 CRITERIA FOR REFERRAL TO SECONDARY-EYE-CARE SERVICES

- ✓ Irrespective of intraocular pressure, patients with one or more of the following findings should be referred to secondary-eye-care services:
  - optic disc signs consistent with glaucoma in either eye
  - a reproducible visual field defect consistent with glaucoma in either eye
  - risk of angle closure (occludable angle)
    - using Van Herick technique, if the peripheral anterior chamber width is one quarter or less of the corneal thickness
    - using gonioscopy, if  $\geq 270$  degrees of posterior pigmented trabecular meshwork is not visible.
- ✓ Patients who have ocular hypertension with intraocular pressure  $>25$  mm Hg may be considered for referral to secondary-eye-care services irrespective of central corneal thickness.
- ✓ Patients who have ocular hypertension with intraocular pressure  $<26$  mm Hg and central corneal thickness  $<555$  micrometers should be referred to secondary-eye-care services if they are aged  $\leq 65$ .
- ✓ Patients who have ocular hypertension with intraocular pressure  $<26$  mm Hg and central corneal thickness  $\geq 555$  micrometers may be monitored in the community.

## 2.5 DISCHARGE FROM SECONDARY-EYE-CARE SERVICES

- ✓ When a patient is discharged from secondary-eye-care services the responsibility for patient care is transferred to the optometrist.
- ✓ Local arrangements for follow up and monitoring in the community should include protocols for communicating with patients who do not attend, or do not respond to invitations to make appointments, and for liaison with general practice and secondary-eye-care services.
- ✓ The following groups may be considered for discharge from secondary-eye-care services where robust local arrangements are in place for follow up and monitoring in the community. Patients with:
  - untreated ocular hypertension where intraocular pressure is  $<26$  mmHg, CCT is  $\geq 555$  micrometers and ocular examination is otherwise normal
  - untreated ocular hypertension with intraocular pressure  $>25$  mm Hg with otherwise normal ocular examination and a low lifetime risk of glaucomatous visual disability
  - treated ocular hypertension where re-referral criteria are documented.
- ✓ Patients with primary angle closure who have had prophylactic iridotomy may be considered for discharge from secondary-eye-care services if they:
  - have confirmed open angle
  - are not on topical medication
  - have no evidence of glaucoma.
- ✓ Patients with treated glaucoma should normally be monitored in secondary-eye-care services  
 Discharge to a locally accredited glaucoma optometrist may be considered at the discretion of the consultant ophthalmologist where this is in the best interests of the patient. Robust local arrangements for follow up and monitoring should be in place and the frequency of monitoring and criteria for re-referral should be individualised.

## 2.6 MONITORING PATIENTS WITH OCULAR HYPERTENSION

- R** For patients with ocular hypertension, treated or untreated, a reliable baseline based on repeated measurement of IOP and perimetry should be established. Repeat glaucoma testing every two years is recommended.

## 3 Risk factors for primary glaucoma

### 3.1 INTRODUCTION

A detailed history including relevant medical, family and ocular history is undertaken as part of a primary eye examination.<sup>7</sup>

- ✓ When referring a patient with suspected glaucoma to secondary-eye-care services, the optometrist should highlight the presence of any glaucoma risk factors.

### 3.2 DEMOGRAPHIC AND NON-OCULAR RISK FACTORS

Meta-analyses of the epidemiology of glaucoma highlight the major demographic and non-ocular risk factors for open-angle glaucoma as increasing age (from age 40), black ethnicity, family history in a first-degree relative, and comorbid diabetes, hypertension and peripheral vascular disease (see Table 1).<sup>1, 13</sup> Key demographic risk factors for angle-closure glaucoma identified in a meta-analysis include increasing age (from age 40), female sex and eastern Asian ethnicity (see Table 2).<sup>14</sup> Estimates vary owing to study inclusion criteria.

Table 1: Risk factors associated with primary open-angle glaucoma  
Estimates from key meta-analyses (95% CI)

Age	% Prevalence <sup>1</sup>	Age	% Prevalence <sup>13</sup>
≥80	7.8 (5.2–12)		
70–79	5.1 (3.6–7.2)	70	3.3 (2.5–4.0)
60–69	3.7 (2.7–5.0)	60	1.4 (1.0–1.9)
50–59	2.2 (1.6–3.0)	50	0.9 (0.6–1.3)
40–49	1.3 (0.9–1.9)	40	0.3 (0.1–0.5)
30–39	1.6 (0.7–3.8)		
<b>Black ethnicity</b>			
	Age-adjusted prevalence % <sup>1</sup>	Odds ratio <sup>1</sup>	Relative risk Over 40 years <sup>13</sup>
	7.5 (6.8–8.4)	2.9 (1.4–5.9)	3.8 (2.56–5.64)
<b>Family history in a first-degree relative</b>			
	Age-adjusted odds ratio <sup>1</sup>		Age-adjusted relative risk <sup>13</sup>
	3.3 (2.0–5.6)		3.14 (2.32–4.25)
<b>Diabetes</b>			
	Odds ratio <sup>1</sup>		Relative risk <sup>13</sup>
	1.8 (1.4–2.4)		1.93 (1.38–2.69)
<b>Hypertension</b>			
	Odds ratio <sup>1</sup>		
	1.8 (1.4–2.3)		
<b>Peripheral vascular disease</b>			
	Odds ratio <sup>1</sup>		
	2.1 (0.83–5.3)		

2<sup>++</sup>

Table 2: Risk factors associated with primary angle-closure glaucoma  
Estimates from key meta-analyses (95% CI)

Age	% Prevalence <sup>14</sup>
≥70	0.94 (0.63–1.35)
60–69	0.20 (0.06–0.42)
50–59	0.60 (0.27–1.00)
40–49	0.02 (0.00–0.08)
Female sex	Female to male ratio <sup>14</sup>
	3.25:1 (1.76–5.94)
Eastern Asian ethnicity	Primary angle-closure glaucoma prevalence is higher in people of Asian and east Asian descent compared with European descent <sup>14</sup>

### 3.3 OCULAR RISK FACTORS

#### 3.3.1 RAISED INTRAOCULAR PRESSURE

Ocular hypertension is defined as intraocular pressure (IOP) consistently greater than 21 mm Hg (in at least one eye) and the absence of clinical signs of glaucoma.<sup>15</sup>

The risk of developing glaucoma increases with increasing IOP.<sup>13</sup> Having a raised IOP, outside the generally agreed population normal range (10–21 mm Hg) is considered to be the most important glaucoma risk factor, as it is the only one that can be treated. People with an IOP within the normal range can develop glaucoma. Multifactorial risk prediction models can be used to quantify the risk of disease.

2++

For the most common type of glaucoma (primary open-angle glaucoma (POAG), three models combining risk factors have been used to derive risk prediction equations for development of the disease.<sup>16</sup> These are based on data from the Ocular Hypertension Treatment Study (OHTS)<sup>17</sup> and the European Glaucoma Prevention Study (EGPS).<sup>18</sup> The OHTS/EGPS risk model is an equation for predicting the five-year risk of POAG in adult patients with ocular hypertension. All of the variables included in the model can be routinely collected in clinical practice: age; IOP; central corneal thickness (CCT); vertical cup-to-disc (C/D) ratio and pattern standard deviation (PSD). A simple calculator based on the model and freely available online enables estimation of the five-year risk of a patient with OHT developing POAG in at least one eye (<http://ohts.wustl.edu/risk/calculator.html>).

2++

The clinical utility of the tool is perceived to be limited as the C/D ratio is subjective and not easily quantified. Also, findings from participants included in research studies may not be generalisable to the general population. However, in an independent validation of this model in four independent cohorts, the discriminative ability, that is the ability of the equation to distinguish between individuals who developed POAG in five years and those who did not, was good. In calibration analyses, however, the equation generally overestimated the observed risk of POAG.<sup>15</sup> Based on these data, further research to update the tool to be more applicable for use in clinical care was recommended. The NICE guideline on glaucoma stratifies glaucoma risk based on age, IOP and CCT.<sup>10</sup>

2++

#### 3.3.2 MYOPIA

Myopia is an important risk factor for open-angle glaucoma. A meta-analysis of 11 cross-sectional studies found that individuals with myopia have around double the risk of glaucoma compared to individuals who do not have myopia, odds ratio (OR) 1.92 (95% CI 1.54 to 2.38).<sup>19</sup> In a meta-analysis, the OR for the presence of glaucoma in high myopia (≥6 diopters) was 5.7 (95% CI 3.1 to 11). There is no linear association between the risk of glaucoma and degree of myopia.<sup>1,19</sup>

2+  
3

- 3.3.3 ANTERIOR CHAMBER DEPTH AND HYPERMETROPIA  
A narrative review notes that patients with angle-closure glaucoma are more likely to be hypermetropic.<sup>3</sup> | 4
- 3.3.4 EXFOLIATION SYNDROME AND PIGMENT DISPERSION SYNDROME  
Narrative reviews note associations between pseudoexfoliation and glaucoma and between pigment dispersion syndrome and glaucoma (*see sections 7.4 and 7.5*).<sup>21,22</sup> | 4

## 4 Primary-care examination and assessment of patients with ocular hypertension or suspected glaucoma

### 4.1 GOOD PRACTICE

- ✓ When referring a patient with suspected glaucoma to secondary-eye-care services the optometrist should indicate findings of tonometry, examination by slit-lamp biomicroscopy to include anterior segment and optic disc, and visual field assessment.
- ✓ Advanced pathology requires urgent referral, which should not be delayed in order to undertake repeat examinations.
- ✓ Offer patients the opportunity to discuss their diagnosis, prognosis and treatment, and provide them with relevant information in an accessible format at initial and subsequent visits.

### 4.2 MEASUREMENT OF INTRAOCULAR PRESSURE

A range of tonometers are used in clinical practice. Goldmann applanation tonometry (GAT) is the currently accepted reference-standard technique for measuring IOP.

No studies were identified comparing GAT with other technologies in terms of referral accuracy or diagnostic accuracy for features suggestive of glaucoma.

A meta-analysis of 99 studies comparing tonometers identified heterogeneity of effect which was, in part, attributed to variability in the reference standard. There was substantial IOP measurement variability for all tonometers including GAT, both within and between studies. Non-contact tonometers (NCT) (4 studies) and hand-held applanation tonometers (HAT) (26 studies) achieved the measurements closest to the GAT with around 59% and 66% within 2 mm Hg respectively and 79% and 85% of measurements within 3 mm Hg respectively.<sup>15</sup>

2<sup>++</sup>

A Health Technology Assessment (HTA) examined the degree of within-patient variability in IOP measurement, using models based on untreated ocular hypertension, and suggested that measurement 'noise' of the order of 3 mm Hg could be reduced by taking the average of two or three measurements at a single visit. Measurement at similar times of day on repeat visits may reduce the impact of diurnal variation.<sup>15</sup>

2<sup>++</sup>

An HTA did not identify any good quality evidence assessing the value of examining the degree of short- or long-term IOP fluctuation as a risk factor for the development or progression of glaucoma.<sup>22</sup>

2<sup>++</sup>

An HTA did not identify any good quality evidence for the use of a diurnal tension curve (multiple IOP measurements over a minimum eight-hour period) in patients with suspected glaucoma who had single IOP measurements within the normal range.<sup>22</sup>

2<sup>++</sup>

**R** For patients with ocular hypertension or suspected glaucoma a reliable baseline measure of intraocular pressure is required. A minimum of two intraocular pressure readings on a single occasion using the same tonometer is recommended. The type of tonometer and the time of measurement should be specified in any referral to secondary-eye-care services.

✓ To promote consistency between primary and secondary care, tonometry should be performed with Goldmann or Perkins type tonometers.

✓ Protocols should be in place for regularly checking calibration to ensure tonometer accuracy.



### 4.3 MEASUREMENT OF CENTRAL CORNEAL THICKNESS

No evidence was identified to show whether or not referral accuracy is improved when CCT measurements are provided in addition to IOP measurements in patients with ocular hypertension.

A high-quality systematic review and meta-analysis identified strong evidence, that in a multivariate model, CCT is a risk factor for progression of ocular hypertension to POAG.<sup>15</sup> 2<sup>++</sup>

A moderate-quality systematic review reported inconsistent findings about the relationship between CCT and glaucoma prevalence or glaucoma progression but identified consistent evidence that CCT is a risk factor for progression of ocular hypertension to glaucomatous optic neuropathy.<sup>23</sup> 2<sup>+</sup>

An evidence-based guideline notes that CCT can act as a confounder of IOP measurement and is therefore of value in interpreting IOP measurements.<sup>10</sup> There is, however, no verified algorithm to apply to the relationship between CCT and IOP.<sup>23</sup> 2<sup>++</sup>

**R** | **Central corneal thickness should be measured in patients with ocular hypertension or suspected glaucoma and reported alongside the measured intraocular pressure results when referring to secondary-eye-care services.**

✓ | Repeat measurements should be taken on a single occasion. This is an inherent feature of ultrasound pachymeters which provide a final reading based on an average of measurements. Mean and standard deviation should be recorded and provided in any referral.

✓ | The type of pachymeter used should be stated on patient records and referrals.

### 4.4 ASSESSMENT OF ANTERIOR CHAMBER ANGLE

Gonioscopy is the reference standard for assessment of the anterior chamber angle in patients with suspected glaucoma or OHT. It is not currently practised by all optometrists and requires experience to interpret the angle appearance. Gonioscopy is unsuitable for some patients particularly where there are anxiety or mobility difficulties.

No systematic reviews of studies comparing methods for anterior chamber angle assessment were identified.

All of the primary studies identified were carried out in entirely or predominantly non-Caucasian groups including Indian, Korean, Chinese and Malay populations, all of which have higher rates of angle closure than Caucasians. Studies were carried out in research settings, where the tests were conducted almost exclusively by glaucoma specialist ophthalmologists, and therefore the results may not be directly applicable to community optometrists.

Where the sensitivity and specificity for detection of narrow angles were reported in comparisons of optical coherence tomography (OCT) with gonioscopy, there was generally high sensitivity (84–100%) but low specificity (41–69%).<sup>24–33</sup> There was variation in the scanning protocols used and issues around the ability of operators to identify the scleral spur as a reference point in the technique. Significant interobserver variability was reported in the identification of angle closure by OCT. In one study the level of agreement between raters was described as poor to fair for Cirrus™ whilst for iVue® it was described as fair.<sup>32</sup> 2<sup>+</sup>  
3

OCT is an evolving technology in terms of assessment of anterior angle and is not currently available to all optometrists.

In one study comparing a Van Herick grading method with gonioscopy there was high sensitivity (84.9%) and high specificity (89.6%) for the identification of narrow angle.<sup>34</sup> A second study reported 61.9% sensitivity and 89.3% specificity.<sup>35</sup> In studies reporting level of agreement one (n=148) reported good agreement between Van Herick and gonioscopy for identification of narrow angles,<sup>29</sup> whilst a smaller study in African patients (n=36) noted poor correlation between the methods.<sup>36</sup> 2<sup>+</sup>  
3

**R** Depending on practitioner’s preference and clinical competence, either the Van Herick method or gonioscopy may be used to detect narrow anterior chamber angles in patients with ocular hypertension or suspected angle closure.

✓ Due to the low specificity of optical coherence tomography, referral to secondary-eye-care services should not be based on the results of anterior chamber OCT measurements alone.

## 4.5 OPTIC DISC ASSESSMENT

### 4.5.1 OPHTHALMOSCOPY

In a meta-analysis of five studies examining the accuracy of ophthalmoscopy for screening for open-angle glaucoma, the pooled sensitivity was 60% (95% credible interval (CrI) 34 to 82) and the pooled specificity was 94% (95% CrI 76 to 99).<sup>13</sup> 2<sup>++</sup>

### 4.5.2 OPTIC DISC ASSESSMENT

A systematic review of the parameters of optic disc assessment reported that for a C/D ratio of  $\geq 0.7$  (four studies), the likelihood ratio (LR) for POAG was 14 (95% CI 5.3 to 39). For a C/D ratio asymmetry  $\geq 0.3$  (three studies) the LR was 7.3 (95% CI 3.3 to 16). The LR associated with the presence of disc haemorrhage (five studies) was 12 (95% CI 2.9 to 48).<sup>1</sup> 2<sup>+</sup>

While the systematic reviews did not specifically address clinical assessment of optic disc size and morphology, evidence from primary research papers confirmed the importance of disc size measurement in the interpretation of the C/D ratio.<sup>37,38</sup> The size of the disc can be rapidly assessed during slit-lamp biomicroscopy and when this is combined with an assessment of the neuroretinal rim morphology, as in Spaeth’s disc damage likelihood scale (DDLS, see Annex 3), it allows discrimination between glaucomatous and normal discs and compares favourably with Heidelberg Retina Tomograph II disc assessment.<sup>39-45</sup> 2<sup>+</sup>  
3

The clinical utility of the ISNT rule (inferior, superior, nasal and temporal) in the diagnosis of glaucomatous neuropathy has been called into question by a number of studies.<sup>46-49</sup> 3

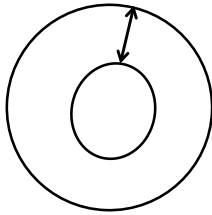
**R** For patients with suspected glaucoma the optic discs should be examined by slit-lamp biomicroscopy. The vertical optic disc diameter should be measured using the slit beam height. This should be corrected for the magnification of the condensing lens, and the disc categorised as small, medium or large.

✓ For optic disc examination in patients with suspected glaucoma, the pupil should be dilated unless there is a high risk of angle-closure.

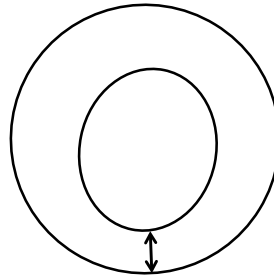
**R** The narrowest rim/disc ratio and disc size should be recorded and considered alongside additional indicators of glaucoma, such as optic disc nerve fibre layer haemorrhage and cup/disc ratio asymmetry, when assessing the need for referral to secondary-eye-care services.

- ✓ Patients with the following optic disc parameters should be considered for referral to secondary-eye-care services:

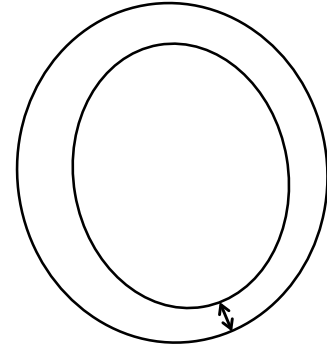
- small discs (<1.5 mm in diameter) where the narrowest rim/disc ratio is <0.3



- medium discs (1.5–2.0 mm in diameter) where the narrowest rim/disc ratio is <0.2



- large discs (>2.0 mm in diameter) where the narrowest rim/disc ratio is <0.1



These parameters correspond to Spaeth's disc damage likelihood scale stage 4 or greater.

- ✓ Referral should not be made solely on the basis of apparent violation of the ISNT rule.
- ✓ Patients with an optic disc nerve fibre layer haemorrhage should be referred irrespective of other signs of glaucoma.

#### 4.5.3 OPTIC DISC PHOTOGRAPHY

In a meta-analysis of six studies examining the accuracy of optic disc photography for screening for open-angle glaucoma the pooled sensitivity was 73% (95% CrI 61 to 83) and the pooled specificity was 89% (95% CrI 50 to 99).<sup>13</sup>

2<sup>++</sup>

**R** The optic discs should be photographed and the images transmitted with the electronic referral letter.

- ✓ Where available, use of stereophotography should be considered.

#### 4.5.4 IMAGING DEVICES

In a meta-analysis of three studies examining the accuracy of the Heidelberg Retina Tomograph II for screening for open-angle glaucoma the pooled sensitivity was 86% (CrI 55 to 97) and the pooled specificity was 89% (95% CrI 66 to 98). No studies of optical coherence tomography or scanning laser polarimetry (GDx instrument) for imaging of the nerve fibre layer met the inclusion criteria.<sup>13</sup>

2<sup>++</sup>

A systematic review compared a range of imaging devices for assessment of the optic disc in diagnosis of glaucoma, including confocal scanning laser ophthalmoscopy, OCT, and scanning laser polarimetry. Nearly all of the studies identified included patients with visual field loss and the review concluded that they did not therefore evaluate the ability of such devices to detect disease in patients with suspected glaucoma. The review also concluded that no one device was superior to any other.<sup>50</sup>

2<sup>++</sup>

There is insufficient evidence supporting additional clinical benefit of OCT or scanning laser polarimetry in the diagnosis of glaucoma to make any recommendation for the primary-care setting.

#### 4.6 VISUAL FIELD ASSESSMENT

No systematic reviews were identified comparing visual field assessment technologies with the outcome of referral accuracy in patients suspected of having glaucoma.

A systematic review of studies published up to November 2005 exploring the accuracy of screening tests for open-angle glaucoma reported the sensitivities and specificities of frequency doubling technology (FDT), oculokinetic perimetry (OKP) and standard automated perimetry (SAP). Table 3 summarises the pooled sensitivity and specificity of the visual function tests (perimetry), combining all available studies. There were few good- quality studies for each test and the inclusion of SAP as part of the reference standard introduced potential bias in some cases. In a subgroup of the studies which assessed early/moderate stage glaucoma the sensitivity of OKP was 25% compared with 97% for SAP. Oculokinetic perimetry, although promising in a screening setting, may not be sufficiently sensitive for case detection in an optometric setting. Two studies in the review directly compared SAP with FDT C-20-5, with both reporting that FDT had superior sensitivity but poorer specificity than SAP.<sup>13, 51</sup>

2++

Table 3: Sensitivity and specificity of visual function tests for detection of open-angle glaucoma<sup>13, 51</sup>

	Studies/high-quality studies	Pooled sensitivity (%) (95% CrI)	Pooled specificity (%) (95% CrI)
FDT C-20-1	3/1	92 (65–99)	94 (73–99)
FDT C-20-5	5/2	78 (19–99)	75 (57–87)
OKP	4/1	86 (29–100)	90 (79–96)
SAP full threshold	5/2	88 (65–97)	80 (55–93)
SAP supra-threshold	9/1	71 (51–86)	85 (73–93)

A narrative review of the effectiveness of visual function tests in diagnosis and monitoring of patients with glaucoma was based on a systematic, but limited, literature search which identified 85 studies. The review concluded that algorithms, such as the Swedish Interactive Thresholding Algorithm (SITA), have led to visual field tests which provide more reliable information than full-threshold SAP testing in this patient group.<sup>52</sup>

2+

- R** For patients with ocular hypertension or suspected glaucoma, standard automated perimetry is recommended for visual field testing. Frequency doubling technology is also acceptable.
- ✓ A minimum of two visual field tests with consistent findings is recommended before referral to secondary-eye-care services. One test may suffice if the result is unequivocal.
- ✓ The use of the same technology in the community and secondary-eye-care services has benefit in allowing direct comparisons to be made between the visual field plots.

## 5 Criteria for referral to secondary-eye-care services

No systematic reviews were identified exploring the clinical effectiveness of different referral criteria.

The following good-practice points for referral are based on the expertise of the SIGN guideline development group informed by the NICE guideline on the diagnosis and management of glaucoma,<sup>10</sup> subsequent joint guidance from the College of Optometrists and the Royal College of Ophthalmologists,<sup>53</sup> and an HTA on surveillance for ocular hypertension.<sup>15</sup>

Development of the criteria has taken account of the views of the eye-care community in Scotland expressed during open consultation and the expertise of invited peer reviewers from within and beyond Scotland.

- ✓ Irrespective of intraocular pressure, patients with one or more of the following findings should be referred to secondary-eye-care services:
  - optic disc signs consistent with glaucoma in either eye
  - a reproducible visual field defect consistent with glaucoma in either eye
  - risk of angle closure (occludable angle)
    - using Van Herick technique, if the peripheral anterior chamber width is one quarter or less of the corneal thickness
    - using gonioscopy, if  $\geq 270$  degrees of posterior pigmented trabecular meshwork is not visible.
- ✓ Patients who have ocular hypertension with intraocular pressure  $>25$  mm Hg may be considered for referral to secondary-eye-care services irrespective of central corneal thickness.
- ✓ Patients who have ocular hypertension with intraocular pressure  $<26$  mm Hg and central corneal thickness  $<555$  micrometers should be referred to secondary-eye-care services if they are aged  $\leq 65$ .
- ✓ Patients who have ocular hypertension with intraocular pressure  $<26$  mm Hg and central corneal thickness  $\geq 555$  micrometers may be monitored in the community.

The current NHSScotland glaucoma referral form can be found in Annex 4.

## 6 Discharge from secondary-eye-care services

### 6.1 FACILITATING SAFE DISCHARGE

- ✓ When deciding if a patient should be discharged from secondary eye-care-services, there should be discussion with the patient to identify and take account of their preferences.
- ✓ When a patient is discharged from secondary-eye-care services the responsibility for patient care is transferred to the optometrist.
- ✓ Local arrangements for follow up and monitoring in the community should include protocols for communicating with patients who do not attend, or do not respond to invitations to make appointments, and for liaison with general practice and secondary-eye-care services.

#### 6.1.1 DISCHARGE LETTERS

- ✓ Discharge letters should include: patient age, diagnosis/condition, visual acuity, central corneal thickness, intraocular pressure, last visual field test, descriptor of optic nerve head, measurement of anterior chamber angle, current medication and information on allergies or adverse reactions to medication.
- ✓ Letters should include instructions on specific indications for re-referral to secondary-eye-care services, such as defined intraocular pressure and should include contact details for direct re-referral.
- ✓ Discharge letters should be addressed to a specified optometrist, which will normally be the referring optometrist, and copied to the patient and to their general practitioner.

A sample discharge letter adapted from NHS Grampian can be found in Annex 5.

#### 6.1.2 PATIENT-HELD RECORD

No systematic reviews were identified on the effectiveness of providing a patient-held record to individuals diagnosed with or at risk of glaucoma.

Three systematic reviews were identified from other healthcare contexts. One of these, pertaining to maternity care, was considered not applicable, particularly owing to the older age group of patients with or at risk of glaucoma.<sup>54</sup>

One systematic review of patient-held records in cancer care was identified. This included seven randomised controlled trials and found an absence of effect, although most patients welcomed the intervention.<sup>55</sup>

A third review identified 14, mainly poor-quality, studies across a range of chronic conditions including diabetes, rheumatoid arthritis and stroke and found no clear evidence of benefit in introducing a patient-held record. Both clinical and process outcomes were examined.<sup>56</sup>

There is no evidence on which to base a recommendation for practice.

#### 6.1.3 NAMED OPTOMETRIST

No applicable systematic reviews were identified on the effectiveness of specifying a named optometrist when discharging individuals diagnosed with or at risk of glaucoma from secondary-eye-care services.

Evidence from a synthesis of qualitative studies suggests that patients with chronic conditions value continuity of care providers.<sup>57</sup>

1<sup>++</sup>2<sup>++</sup>

3

## 6.2 DISCHARGE CRITERIA

A systematic review of the organisation of eye-care services summarised descriptive studies of shared and delegated-care schemes and identified one RCT (n=403) reporting a high level of diagnostic and management clinical concordance between highly specialist accredited optometrists and consultant ophthalmologists during two years of follow up of patients with glaucoma or suspected glaucoma.<sup>58</sup> This finding may be limited in its applicability to routine optometry practice in the community.<sup>59</sup>

No systematic reviews were identified exploring the clinical effectiveness of different discharge criteria.

The following good-practice points for discharge are based on the expertise of the SIGN guideline development group applied within the provisions of the GOS arrangements and are informed by the NICE guideline on the diagnosis and management of glaucoma,<sup>10</sup> subsequent joint guidance from the College of Optometrists and the Royal College of Ophthalmologists<sup>53</sup> and an HTA on surveillance for ocular hypertension.<sup>15</sup>

Development of the criteria has taken account of the views of the eye-care community in Scotland expressed during open consultation and the expertise of invited peer reviewers from within and beyond Scotland.

### 6.2.1 PATIENTS WITH OCULAR HYPERTENSION

- ✓ The following groups may be considered for discharge from secondary-eye-care services where robust local arrangements are in place for follow up and monitoring in the community. Patients with:
  - untreated ocular hypertension where intraocular pressure is <26 mm Hg, CCT is ≥555 micrometers and ocular examination is otherwise normal
  - untreated ocular hypertension with intraocular pressure >25 mm Hg with otherwise normal ocular examination and a low lifetime risk of glaucomatous visual disability
  - treated ocular hypertension where re-referral criteria are documented.

### 6.2.2 PATIENTS WHO HAVE HAD IRIDOTOMY

- ✓ Patients with primary angle closure who have had prophylactic iridotomy may be considered for discharge from secondary-eye-care services if they:
  - have confirmed open angle
  - are not on topical medication
  - have no evidence of glaucoma.

### 6.2.3 PATIENTS WITH TREATED GLAUCOMA

- ✓ Patients with treated glaucoma should normally be monitored in secondary-eye-care services.
 

Discharge to a locally accredited glaucoma optometrist may be considered at the discretion of the consultant ophthalmologist where this is in the best interests of the patient. Robust local arrangements for follow up and monitoring should be in place and the frequency of monitoring and criteria for re-referral should be individualised.

## 7 Monitoring at-risk groups

### 7.1 PATIENTS WITH FAMILY HISTORY OF GLAUCOMA

- ✓ Where family history of glaucoma in a first-degree relative is the sole risk factor identified at routine eye examination, the patient should be recalled for review at least every two years. If additional risk factors are present the patient should be reviewed annually or more frequently depending on clinical judgement.

### 7.2 PATIENTS WITH OCULAR HYPERTENSION

The NICE guideline on the diagnosis and management of glaucoma did not identify any clinical or economic evidence on the optimal monitoring interval for patients with ocular hypertension and recommended, based on expert opinion, that monitoring should be based on risk of conversion to glaucoma.<sup>10</sup>

An evidence synthesis and economic evaluation explored optimal monitoring pathways for people with ocular hypertension. A survey of public preferences for a monitoring service identified the importance of keeping any side effects of treatment to a minimum and highlighted the value of good communication between patients and healthcare professionals. Analysis of the survey also found that patient understanding of the monitoring and testing process was an important predictor of the perceived value of a monitoring service.<sup>15</sup>

Modelling suggests that once reliable baseline measures (IOP (treated or untreated) and visual fields) are ascertained there is no clear benefit in intensive monitoring to detect glaucoma. Limited data were available on the long-term variability of visual field parameters. Biennial monitoring, by practitioners experienced in glaucoma, was more cost effective than more frequent monitoring.<sup>15</sup>

**R** For patients with ocular hypertension, treated or untreated, a reliable baseline based on repeated measurement of IOP and perimetry should be established. Repeat glaucoma testing every two years is recommended.

- ✓ Documentation of baseline optic nerve status is recommended.

- ✓ The testing process and, if applicable, potential side effects related to treatment should be fully explained to patients.

### 7.3 PATIENTS WHO HAVE HAD PROPHYLACTIC IRIDOTOMY SECONDARY TO PRIMARY ANGLE CLOSURE

Primary angle closure (PAC) is diagnosed as occludable angle, normal optic discs and visual fields and any of the following: peripheral anterior synechiae, elevated intraocular pressure, iris whirling, 'glaucomflecken' lens opacities, or excessive pigment deposition on the trabecular surface. Primary angle closure with evidence of glaucoma is primary angle closure glaucoma (PACG).<sup>60</sup>

In one observational study conducted in Scotland, PACG accounted for approximately 23% of all newly diagnosed cases of glaucoma.<sup>61</sup>

No systematic reviews or meta-analyses were identified on the monitoring of patients with PAC after iridotomy with healthy discs and full visual field.

Three observational studies; a retrospective study from Canada and two small prospective studies from India were identified which provided information on the risk of glaucoma in this patient group.



A retrospective single-cohort study (n=257, 469 eyes) examined the risk of IOP elevation and requirement for intervention in patients with iridotrabecular contact or peripheral anterior synechiae who had peripheral iridotomy carried out. Clock hour of apposition of the angle was not recorded and indentation gonioscopy was not performed. At mean follow up of 8.5 years, 38.7% of the eyes had increased IOP and 17.3% required antiglaucoma treatment.<sup>62</sup>

3

A small (n=72) prospective single-cohort study reported 36.1% of patients with raised IOP and 11.1% with PACG after mean follow up of 6.89 years. This study also reported increased risk of raised IOP/glaucoma in older patients, those with higher baseline IOP and longer follow up.<sup>63</sup>

3

Another small (n=28) prospective single-cohort study reported that at five years, 28% of patients had progressed to glaucoma, with or without medications.<sup>64</sup>

3

No evidence was identified on which to base recommendations on follow-up interval or on the most appropriate healthcare setting for monitoring.

- ✓ Patients with primary angle closure or suspected primary angle closure who have undergone successful iridotomy require lifelong monitoring which can be carried out in primary care. Monitoring should include measurement of intraocular pressure and visual fields as well as assessment of optic discs and anterior chamber depth.

## 7.4 PATIENTS WITH PSEUDOEXFOLIATION

Pseudoexfoliation is one of the most common identifiable causes of glaucoma and pseudoexfoliation glaucoma is more severe and difficult to manage than primary open-angle glaucoma.<sup>65</sup> Around 30–50% of patients with pseudoexfoliation will develop glaucoma.<sup>66</sup> It is also reported to be associated with angle-closure glaucoma.<sup>67</sup>

4  
3

No studies were identified which investigated the monitoring interval for this group of patients.

- ✓ Individuals with signs of pseudoexfoliation require ongoing monitoring owing to their increased risk of developing glaucoma. If there are no clinical signs of ocular hypertension or glaucoma the patient can be monitored in the community.

## 7.5 PATIENTS WITH PIGMENT DISPERSION SYNDROME

Patients with pigment dispersion syndrome have an increased risk of developing glaucoma.<sup>21</sup> The reported risk of conversion of pigment dispersion syndrome to pigmentary glaucoma varies widely from 15% in 15 years to 50% in four years, with IOP at presentation being a predictive factor.<sup>68</sup>

4  
3

No studies were identified which investigated the monitoring interval for this group of patients.

- ✓ Individuals with pigment dispersion syndrome require ongoing monitoring owing to the increased risk of developing glaucoma. If there are no clinical signs of ocular hypertension or glaucoma at presentation the patient can be monitored in the community.

## 7.6 PATIENTS WITH OPTIC DISC ANOMALIES

### 7.6.1 INTRODUCTION

There are a number of common non-glaucomatous optic nerve head anomalies which can resemble glaucomatous disease. Optometrists should follow the relevant clinical guidelines and protocols in keeping with each of these conditions and exercise clinical judgement with regard to ongoing monitoring or referral. It is considered good practice to use digital image capture to monitor morphological change.

## 7.6.2 MYOPIC DISCS

No studies were identified which investigated the monitoring interval for this group of patients.

- ✓ Individuals with myopic discs require ongoing monitoring owing to the increased risk of developing glaucoma. If there are no clinical signs of ocular hypertension or glaucoma at presentation the patient can be monitored in the community.

## 7.6.3 TILTED OPTIC DISC

A review with a limited literature search concluded that tilted optic disc is not associated with any increased risk of developing glaucoma.<sup>69</sup> Tilted disc can mimic various types of visual field defect suggestive of normal-tension glaucoma in the absence of raised intraocular pressure. Careful interpretation of visual fields is necessary to avoid incorrect diagnosis.<sup>70</sup> The sensitivity and specificity of newer technologies that image the optic nerve head and retinal nerve fibre layer in diagnosis of glaucoma in tilted optic disc are reported to be very low.<sup>69</sup>

No studies were identified which investigated the monitoring interval for this group of patients.

- ✓ Healthcare practitioners should be aware that tilted optic disc is not associated with any increased risk of glaucoma. Visual field defect mimicking glaucoma is common in patients with tilted optic disc, but, in contrast to glaucomatous optic damage, the defect is non-progressive, located temporally, and not dense.

## 7.6.4 OPTIC DISC DRUSEN

Optic nerve head drusen (ONHD) can be associated with VFL. A small retrospective cohort study (n=60, 103 eyes) compared rates of VFL in patients with ONHD with and without ocular hypertension. While 90.9% of eyes with OHT had VFL, 66.7% of normotensive eyes had VFL (p=0.03). At the same intraocular pressure, eyes with grade III ONHD are at increased risk for VFL when compared with eyes with grade I ONHD.<sup>71</sup>

No studies were identified which investigated the monitoring interval for this group of patients.

- ✓ Patients with optic nerve head drusen who are normotensive and show no evidence of glaucoma can be followed up by community optometrists. Patients with optic nerve head drusen, with ocular hypertension and/or a visual field defect require more frequent follow up owing to the increased risk of developing glaucoma and should be referred to secondary-eye-care services.

## 8 Provision of information

### 8.1 INTRODUCTION

Glaucoma and its risk factors are not well understood, neither by the general public nor among patients. This makes early detection and ongoing management of this condition challenging. The lack of knowledge and understanding means that patients with this disease, and their carers, are often unable to contribute fully to the management of their glaucoma. This is a critical factor in ensuring that patients retain functional vision and quality of life for as long as possible. It is important that patients understand their condition and its management at the point of diagnosis and into the future. The ideal situation is that patients and carers are well informed and fully participate in the decision-making process with their clinical teams to ensure the best outcomes through their lifetime of care.

Patient-friendly information delivered at appropriate points in the patient journey, with time given for counselling, helps to promote understanding. Educating patients about their condition and helping them manage their eye-drop routines improves patient adherence to therapy and thereby enhances the chance of a successful outcome in the long term.<sup>72</sup>

Some groups, for example older people, people with learning disabilities and those in remote areas may require mobile facilities to provide access to eye-care services and formal and informal carers may benefit from training in eye health and eye care for these individuals.

This section reflects the issues likely to be of most concern to patients and their carers. These points are provided for use by healthcare professionals when discussing glaucoma with patients and carers and in guiding the production of locally-produced information materials.

### 8.2 KEY MESSAGES FROM PATIENTS WITH GLAUCOMA

A focus group was held with patients who have glaucoma in September 2013. The aim of the focus group was to hear about their experiences of services in relation to information provision. Eight people took part, six men and two women. The key messages are highlighted in the checklist below, which also incorporates relevant points from the NICE guideline on glaucoma diagnosis and management.<sup>10</sup>

### 8.3 CHECKLIST FOR PROVISION OF INFORMATION

This section gives examples of the information patients and carers may find helpful at the key stages of the patient journey. The checklist is neither exhaustive nor exclusive.

<b>General</b>
<ul style="list-style-type: none"> <li>• Emphasise the importance of regular eye tests for all individuals.</li> <li>• At all times consider language and communication support needs to ensure that people with English as a second language, those with learning disability/cognitive impairment and people with visual loss receive good-quality accessible information throughout their patient journey.</li> </ul>
<b>Initial presentation and referral</b>
<ul style="list-style-type: none"> <li>• Advise patients of the need for referral to a specialist and of expected waiting times.</li> <li>• Explain what glaucoma is and what to expect at the appointment with the specialist.</li> <li>• Reassure the patient that if the diagnosis is confirmed early, intervention can help preserve useful sight and that with effective treatments patients are able to enjoy a good quality of life.</li> <li>• Highlight the importance of attending the appointment.</li> <li>• Advise patients not to drive to the appointment owing to the likelihood of pupil dilation and to take along a carer/friend/family member with them if possible.</li> <li>• Suggest that patients note down any questions and concerns they may wish to discuss at the meeting.</li> </ul>

<b>Secondary-eye-care services</b>
<ul style="list-style-type: none"> <li>• Explain procedures to the patient using appropriate language and level of detail and ensure comprehension.</li> <li>• Discuss the importance of monitoring progression of glaucoma risk factors and emphasise that although sight lost with glaucoma cannot be recovered, adherence to treatment can preserve remaining sight.</li> <li>• Provide information on or referral to local sight support services where appropriate.</li> <li>• Allow sufficient time for answering any questions patients and carers may have eg: <ul style="list-style-type: none"> <li>– what does glaucoma mean?</li> <li>– what type of glaucoma do I have?</li> <li>– will I go blind?</li> <li>– will I need to stay in hospital?</li> <li>– can I still drive?</li> </ul> </li> <li>• Where appropriate advise patients of their rights and responsibilities in line with current DVLA requirements.</li> <li>• Where appropriate explain the Certificate of Blindness or Defective Vision and its implications.</li> <li>• Consolidate verbal information on glaucoma and medication use with written information.</li> <li>• Consider describing how the medication works to prevent further damage to the optic nerve.</li> <li>• Point out that glaucoma often runs in families and that close family members aged over 40 should be encouraged to book an appointment at their local optometrist to receive an NHS-funded eye-health check. Early detection and treatment of the condition can preserve useful sight and quality of life well into old age.</li> </ul>
<b>Discharge into the community</b>
<ul style="list-style-type: none"> <li>• Provide patients with a copy of their discharge letter and clear information on who to contact should they have any concerns.</li> <li>• Provide patients with written information on their condition.</li> <li>• Allow sufficient time to discuss the following: <ul style="list-style-type: none"> <li>– cleansing eyes and general eye hygiene</li> <li>– how and when to take medication</li> <li>– tuition and practice in the most appropriate instillation technique including punctal occlusion and use of devices and eye-drop aids where necessary</li> <li>– side effects from medication</li> <li>– storing medication.</li> </ul> </li> <li>• Advise self carers of the local support available and how to access this.</li> <li>• Provide patients with information on issues regarding driving with glaucoma, explaining DVLA requirements.</li> <li>• Emphasise the importance of attending follow-up appointments.</li> <li>• Provide patients with information on eye hygiene.</li> <li>• Advise patients to make a note of any questions they have and take it with them to follow-up appointments.</li> </ul>

## 8.4 SOURCES OF FURTHER INFORMATION

### **IGA - International Glaucoma Association**

Woodcote House, 15 Highpoint Business Village, Henwood, Ashford, Kent, TN24 8DH

Helpline: 01233 648170

[www.glaucoma-association.com](http://www.glaucoma-association.com) • Email: [info@iga.org.uk](mailto:info@iga.org.uk)

A UK charity which works to prevent glaucoma blindness by providing information and advice.

### **NHS Inform**

[www.nhsinform.co.uk](http://www.nhsinform.co.uk)

The organisation provides quality-assured health information for the public.

### **Royal College of Ophthalmologists**

[www.rcophth.ac.uk/patients/](http://www.rcophth.ac.uk/patients/)

The Royal College of Ophthalmologists produces a range of patient booklets which may be downloaded

### **Royal National Institute of Blind People (RNIB)**

Helpline Tel: 0303 123 9999

[www.rnib.org.uk](http://www.rnib.org.uk) • Email: [helpline@rnib.org.uk](mailto:helpline@rnib.org.uk)

The RNIB provides practical and emotional support for people affected by sight loss.

### **Sightline**

[www.sightlinedirectory.org.uk](http://www.sightlinedirectory.org.uk)

Sightline is an online directory of services and organisations that help blind and partially sighted people in the UK.

## 9 Implementing the guideline

### 9.1 IMPLEMENTATION STRATEGY

Implementation of national clinical guidelines is the responsibility of each NHS board and is an essential part of clinical governance. Mechanisms should be in place to review care provided against the guideline recommendations. The reasons for any differences should be assessed and addressed where appropriate. Local arrangements should then be made to implement the national guideline in individual hospitals, units and practices.

### 9.2 RESOURCE IMPLICATIONS OF KEY RECOMMENDATIONS

The guideline development group identified the following resource implications:

- Requirement for optometrists to purchase pachymeters where these are not currently in use. These will cost around £1,500 to £2,000 per item.
- Provision of training for optometrists in use of the DDLS and time out of practice to accommodate this.
- Primary-care costs associated with developing robust arrangements for follow up and monitoring of patients with or at risk of glaucoma following their discharge from secondary-eye-care services.
- Secondary-care costs associated with establishing and maintaining discharge protocols. These may include the development of a glaucoma register at a national or local level and a hospital-based glaucoma co-ordinator to manage referrals to community practitioners and audit referral, discharges and recall frequency.

### 9.3 AUDITING CURRENT PRACTICE

A first step in implementing a clinical practice guideline is to gain an understanding of current clinical practice. Audit tools designed around guideline recommendations can assist in this process. Audit tools should be comprehensive but not time consuming to use. Successful implementation and audit of guideline recommendations requires good communication between staff and multidisciplinary team working.

The guideline development group has identified the following as key points to audit to assist with the implementation of this guideline:

- The proportion of referrals from community optometrists to secondary-eye-care services with complete information on IOP, visual fields and optic nerve head assessment.
- The number of patients with IOP <26 mm Hg who are referred to secondary-eye-care services.
- The proportion of false positive glaucoma referrals/overall referral accuracy.
- The number of patients who are discharged from secondary-eye-care services to the community and proportion of these who are subsequently re-referred.
- The number of blind/partial sight registrations due to glaucoma.

## 10 The evidence base

### 10.1 SYSTEMATIC LITERATURE REVIEW

The evidence base for this guideline was synthesised in accordance with SIGN methodology. A systematic review of the literature was carried out using an explicit search strategy devised by a SIGN Evidence and Information Scientist. Databases searched include Medline and the Cochrane Library. The year range covered was 2007–2014. The main searches were supplemented by material identified by individual members of the development group. Each of the selected papers was evaluated by two members of the group using standard SIGN methodological checklists before conclusions were considered as evidence.

### 10.2 RECOMMENDATIONS FOR RESEARCH

The guideline development group was not able to identify sufficient evidence to answer all of the key questions asked in this guideline (*see Annex 2*). The following areas for further research have been identified:

- A comparison of alternative tonometers with investigation of all factors influencing IOP measurements.
- Studies assessing the level of agreement in CCT readings between currently available devices and a reference standard measure.
- Studies assessing the reliability of CCT and need for repeated measures.
- Investigation of the accuracy of referrals based solely on visual field defects.
- Intra- and inter-observer variability in DDLS assessment by optometrist before and after targeted training.
- Comparisons of agreement and reliability of anterior chamber angle assessment (Van Herick method and OCT) in community practice with gonioscopy conducted in the hospital eye service.
- An update of the OHTS/EGPS five-year glaucoma risk-prediction model to be more applicable for use in clinical care.
- Studies assessing risk of primary angle closure postiridotomy converting into primary angle closure glaucoma requiring long-term topical medication or surgical intervention.
- The comparative effectiveness of alternative monitoring intervals for patients with primary angle-closure postiridotomy.
- The comparative effectiveness of optometry-led versus ophthalmology-led follow up for patients with ocular hypertension or glaucoma, to include clinical outcomes and patients' satisfaction.
- Cohort data to determine the optimal frequency of monitoring, for those with glaucoma or at risk of glaucoma, to detect glaucoma progression.
- Studies assessing the feasibility of a national glaucoma register.
- Studies assessing components of glaucoma accreditation/qualification for managing patients with or at risk of glaucoma in primary care.

### 10.3 REVIEW AND UPDATING

This guideline was published in 2015 and will be considered for review in three years. Any updates to the guideline in the interim period will be noted on the SIGN website: [www.sign.ac.uk](http://www.sign.ac.uk)

# 11 Development of the guideline

## 11.1 INTRODUCTION

SIGN is a collaborative network of clinicians, other healthcare professionals and patient organisations and is part of Healthcare Improvement Scotland. SIGN guidelines are developed by multidisciplinary groups of practising clinicians using a standard methodology based on a systematic review of the evidence. Further details about SIGN and the guideline development methodology are contained in 'SIGN 50: A Guideline Developer's Handbook', available at [www.sign.ac.uk](http://www.sign.ac.uk)

## 11.2 THE GUIDELINE DEVELOPMENT GROUP

Dr Roshini Sanders (Chair)	<i>Consultant in Ophthalmology, Queen Margaret Hospital, Dunfermline</i>
Dr Pankaj Agarwal	<i>Consultant in Ophthalmology (Glaucoma Specialist), Princess Alexandra Eye Pavilion, Edinburgh</i>
Ms Gillian Bruce	<i>Optometrist, Edinburgh</i>
Dr Jennifer Burr	<i>Reader, University of St Andrews</i>
Mr Peter Carson	<i>Optometrist, Optometry Scotland, Glasgow</i>
Mr Ian Clement	<i>Lay Representative, Edinburgh</i>
Mrs Lisa Cowan	<i>Senior Postgraduate Optometry Tutor, NHS Education for Scotland, Glasgow</i>
Dr Alastair Glennie	<i>General Practitioner, Kemnay</i>
Mr John Hughes	<i>Development Manager (Scotland), International Glaucoma Association</i>
Dr Manjula Kumarasamy	<i>Consultant in Ophthalmology (Glaucoma Specialist), Aberdeen Royal Infirmary</i>
Mrs Lorna McKay	<i>Highly Specialist Orthoptist, Southern General Hospital, Glasgow</i>
Ms Shirley Miller	<i>Ophthalmic Glaucoma Nurse Practitioner, Queen Margaret Hospital, Dunfermline</i>
Dr Donald Montgomery	<i>Consultant in Ophthalmology (Glaucoma Specialist), Glasgow Royal Infirmary</i>
Mr Frank Munro	<i>Chair, NHS Education for Scotland Optometric Advisory Committee</i>
Mr Hal Rollason	<i>Optometrist, College of Optometrists, London</i>
Dr Carolyn Sleith	<i>Evidence and Information Scientist, SIGN</i>
Dr Andreas Syrogiannis	<i>Specialty Registrar in Ophthalmology, Ninewells Hospital, Dundee</i>
Dr Lorna Thompson	<i>Programme Manager, SIGN</i>

The membership of the guideline development group was confirmed following consultation with the member organisations of SIGN. All members of the guideline development group made declarations of interest. A register of interests is available in the supporting material section for this guideline at [www.sign.ac.uk](http://www.sign.ac.uk)

Guideline development and literature review expertise, support and facilitation were provided by the SIGN Executive. All members of the SIGN Executive make yearly declarations of interest. A register of interests is available on the contacts page of the SIGN website [www.sign.ac.uk](http://www.sign.ac.uk)

Mr Euan Bremner	<i>Project Officer</i>
Mrs Lesley Forsyth	<i>Events Co-ordinator</i>
Mrs Karen Graham	<i>Patient Involvement Officer</i>
Ms Karen King	<i>Distribution and Office Co-ordinator</i>
Mr Stuart Neville	<i>Publications Designer</i>
Miss Gaynor Rattray	<i>Guideline Co-ordinator</i>



## 11.3 CONSULTATION AND PEER REVIEW

### 11.3.1 NATIONAL OPEN MEETING

A national open meeting is the main consultative phase of SIGN guideline development, at which the guideline development group presents its draft recommendations for the first time. The national open meeting for this guideline was held on 20 March 2014 and was attended by 131 representatives of all the key specialties relevant to the guideline. The draft guideline was also available on the SIGN website for a limited period at this stage to allow those unable to attend the meeting to contribute to the development of the guideline.

### 11.3.2 SPECIALIST REVIEWERS INVITED TO COMMENT ON THIS DRAFT

This guideline was also reviewed in draft form by the following independent expert referees, who were asked to comment primarily on the comprehensiveness and accuracy of interpretation of the evidence base supporting the recommendations in the guideline. The guideline group addresses every comment made by an external reviewer, and must justify any disagreement with the reviewers' comments. All expert referees made declarations of interest and further details of these are available on request from the SIGN Executive.

SIGN is very grateful to all of these experts for their contribution to the guideline.

Mrs Chigozie Joe Adigwe	<i>Senior Preventions Officer, Royal National Institute of Blind People Scotland, Glasgow</i>
Dr Balkishan Agrawal	<i>Sessional GP and Expert Member of South East Scotland Research Ethics Committee 02 and Member of ACCORD University of Edinburgh Research Ethics Committee, Edinburgh</i>
Professor Augusto Azuara-Blanco	<i>Professor of Ophthalmology, Queen's University Belfast</i>
Dr Caroline Cobb	<i>Consultant Ophthalmologist, Ninewells Hospital, Dundee</i>
Miss Rebecca Daly	<i>Independent Prescribing Optometrist, Edinburgh</i>
Dr Amit Datta	<i>Consultant Ophthalmologist, Hairmyres Hospital, East Kilbride</i>
Ms Cecelia Fenerty	<i>Consultant Ophthalmologist, Manchester Royal Eye Hospital</i>
Dr Alasdair Fern	<i>Consultant Ophthalmologist, Hairmyres Hospital, East Kilbride</i>
Professor Brian Fleck	<i>Consultant Paediatric Ophthalmologist, Royal Hospital for Sick Children, Edinburgh</i>
Ms Mary Gallagher	<i>Emergency Ophthalmic Nurse Practitioner, Princess Alexandra Eye Pavilion, Edinburgh</i>
Mrs Heather Goodare	<i>Lay Representative, Edinburgh</i>
Dr Robert Harper	<i>Optometrist Consultant, Manchester Royal Eye Hospital</i>
Dr Ross Munro Henderson	<i>Independent Prescribing Optometrist and Optometric Adviser (NHS Tayside), Perth</i>
Ms Samara Hodi	<i>Optometrist Principal, Raigmore Hospital, Inverness</i>
Ms Angela James	<i>Ophthalmic Pharmacist, Princess Alexandra Eye Pavilion, Edinburgh</i>
Mr Ian Jarvis	<i>Community Optometrist, Dundee</i>
Dr Gunter Loffler	<i>Programme Organiser, Glasgow Caledonian University</i>
Professor Caroline MacEwen	<i>Consultant Ophthalmologist, Ninewells Hospital, Dundee</i>
Mrs Kirsty MacFarlane	<i>Principal Pharmacist, Scottish Medicines Consortium, Glasgow</i>
Ms Pam McClean	<i>NES Senior Postgraduate Optometry Tutor, NHS Education for Scotland, Edinburgh</i>
Mr Stephen McPherson	<i>Optometrist, Aberdeen</i>

Mrs Lorraine North	<i>Lead of Glaucoma and Retinal Disease Special Interest Groups for British and Irish Orthoptic Society, Frimley Park Hospital, Surrey</i>
Mr Derek Ogle	<i>Lay Representative, Bo'ness</i>
Dr Janet Pooley	<i>Programme Director (Optometry), NHS Education for Scotland, Edinburgh</i>
Dr Alan Rotchford	<i>Consultant Ophthalmologist, The Tennent Institute of Ophthalmology, Glasgow</i>
Ms Mary Shaw	<i>Senior Lecturer, Manchester Royal Eye Hospital, Manchester</i>
Dr George Spaeth	<i>Esposito Research Professor, Wills Eye Hospital/Jefferson Medical College, Philadelphia</i>
Professor John Sparrow	<i>Consultant Ophthalmologist, Honorary Professor of Ophthalmic Health Services Research and Applied Epidemiology, University of Bristol</i>
Dr Niall Strang	<i>Subject Lead in Visual Science, Glasgow Caledonian University</i>
Professor Steven Taylor	<i>Optometry Advisor, Dorset</i>
Dr Prem Venkatesh	<i>Consultant Ophthalmologist, Inverclyde Royal Hospital, Greenock</i>
Professor Stephen Vernon	<i>Honorary Professor of Ophthalmology and Consultant Glaucoma Specialist, University Hospital, Nottingham</i>
Dr David Wardrop	<i>Consultant Ophthalmologist, Falkirk Community Hospital</i>
	<i>Association of Optometrists</i>
	<i>The College of Optometrists, London</i>
	<i>International Glaucoma Association, Ashford, Kent</i>
	<i>Scottish Optometric Advisers Group</i>

### 11.3.3 SIGN EDITORIAL GROUP

As a final quality control check, the guideline is reviewed by an editorial group comprising the relevant specialty representatives on SIGN Council to ensure that the specialist reviewers' comments have been addressed adequately and that any risk of bias in the guideline development process as a whole has been minimised. All members of SIGN Council make yearly declarations of interest. A register of interests is available on the SIGN Council Membership page of the SIGN website [www.sign.ac.uk](http://www.sign.ac.uk). The editorial group for this guideline was as follows:

Dr Michael Gavin	<i>SIGN Council Representative, Royal College of Ophthalmologists</i>
Dr Roberta James	<i>SIGN Programme Lead; Co-Editor</i>
Professor John Kinsella	<i>Chair of SIGN; Co-Editor</i>

## Abbreviations

<b>CCT</b>	central corneal thickness
<b>C/D</b>	cup-to-disc
<b>CG</b>	clinical guideline
<b>CI</b>	confidence interval
<b>CrI</b>	credible interval
<b>DDLS</b>	disc damage likelihood scale
<b>DVLA</b>	Driver and Vehicle Licensing Agency
<b>EGPS</b>	European Glaucoma Prevention Study
<b>FDT</b>	frequency doubling technology
<b>GAT</b>	Goldmann applanation tonometry
<b>GOS</b>	General Ophthalmic Services
<b>GMC</b>	General Medical Council
<b>HAT</b>	hand-held applanation tonometer
<b>HTA</b>	health technology assessment
<b>IOP</b>	intraocular pressure
<b>ISNT</b>	inferior, superior, nasal and temporal
<b>LR</b>	likelihood ratio
<b>MA</b>	marketing authorisation
<b>MTA</b>	multiple technology appraisal
<b>NCT</b>	non-contact tonometry
<b>NICE</b>	National Institute for Health and Care Excellence
<b>OCT</b>	optical coherence tomography
<b>OHT</b>	ocular hypertension
<b>OHTS</b>	Ocular Hypertension Treatment Study
<b>OKP</b>	oculokinetic perimetry
<b>ONHD</b>	optic nerve head drusen
<b>OR</b>	odds ratio
<b>PACG</b>	primary angle-closure glaucoma
<b>POAG</b>	primary open-angle glaucoma
<b>PSD</b>	pattern standard deviation
<b>SAP</b>	standard automated perimetry
<b>SIGN</b>	Scottish Intercollegiate Guidelines Network
<b>SITA</b>	Swedish Interactive Thresholding Algorithm
<b>SMC</b>	Scottish Medicines Consortium
<b>VFL</b>	visual field loss

# Annex 1

## The Scottish general ophthalmic arrangements

The NHS (General Ophthalmic Services) (Scotland) amendment regulations specify the following patient categories and associated tests in relation to eye examination for suspected glaucoma.

The NHS (General Ophthalmic Services) (Scotland) amendment regulations 2010. <a href="http://www.aop.org.uk/uploads/regulatory/Scotland/scottish_gos_regulations_2014.pdf">www.aop.org.uk/uploads/regulatory/Scotland/scottish_gos_regulations_2014.pdf</a>	
<b>Maximum frequency of primary eye examinations</b>	
Patients aged 40 years or over with a close family* history of glaucoma  *father, mother, brother, sister, son, daughter	Annually
<b>The additional tests and procedures to be undertaken as part of a primary eye examination depending on the presenting signs and symptoms of the patient</b>	
Adults aged 40 years and over who have a family history of glaucoma	Intraocular pressure measurement, automated supra-threshold visual field tests, and assessment of the optic nerve head
Patients with suspect glaucoma or ocular hypertensives	Intraocular pressure measurement by non-contact or applanation tonometry as appropriate, automated supra-threshold visual field tests, and assessment of the optic nerve head
<b>The tests and procedures to be undertaken as part of a supplementary eye examination depending on the circumstances of the patient</b>	
Suspect glaucoma, unusual optic disc appearance, or where other retinal or choroidal abnormalities have been detected during the primary eye examination	To include, as required:  Repeat of automated visual field assessment by full threshold visual fields  Repeat tonometry by contact applanation  Repeat internal examination of the eyes appropriate to the relevant detected or suspected eye abnormality, for example using slit-lamp biomicroscopy with condensing lens, repeat digital imaging or scanning which may include mydriasis

## Annex 2

### Key questions used to develop the guideline

This guideline is based on a series of structured key questions that define the target population, the intervention, diagnostic test, or exposure under investigation, the comparison(s) used and the outcomes used to measure efficacy, effectiveness, or risk. These questions form the basis of the systematic literature search.































Key question	See guideline section
<p>1. In adult patients where the optometrist suspects glaucomatous disease at eye examination, which optic disc assessment techniques and parameters are associated with the greatest referral accuracy or diagnostic accuracy for symptoms suggestive of glaucoma?</p> <p><i>Consider:</i> funduscopy versus funduscopy with dilation versus digital imaging (including stereophotography, monophotography, optical coherence tomography, scanning laser polarimeter, Heidelberg retinal tomograph scanning laser ophthalmoscopy/retinal nerve fibre imaging).</p>	4.5
<p>2. In adult patients where the optometrist suspects glaucomatous disease at eye examination, which techniques for assessment of intraocular pressure are associated with greatest referral accuracy?</p> <p><i>Consider:</i> Goldmann applanation tonometer, non-contact tonometry, hand-held applanation tonometers, Perkins. Single readings versus repeat. Diurnal variation and variation within settings.</p>	4.2
<p>3. In adult patients where the optometrist suspects ocular hypertension at eye examination, does measurement and reporting of central corneal thickness improve referral accuracy when provided in addition to intraocular pressure? Which method of pachymetry should be used?</p>	4.3
<p>4. In adult patients where the optometrist suspects glaucomatous disease at eye examination, which visual field assessment techniques are associated with the greatest referral accuracy or diagnostic accuracy for symptoms suggestive of glaucoma?</p> <p><i>Consider:</i> threshold automated perimetry, repeated testing, standard automated perimetry, short-wavelength automated perimetry, matrix frequency doubling technology, Swedish Interactive Thresholding Algorithm, Dicon, Henson, Humphrey.</p>	4.6
<p>5. In adult patients where the optometrist suspects ocular hypertension at eye examination, does measurement and reporting of angle width improve the referral accuracy? Which method of angle-width assessment should be used?</p> <p><i>Consider:</i> Gonioscopy, Van Herick, Redmond Smith, anterior segment optical coherence tomography.</p>	4.4

<p>6. At what interval and in which setting should monitoring of the following patients groups be conducted:</p> <ul style="list-style-type: none"> <li>a. Patients diagnosed with glaucoma</li> <li>b. Patients with family history of glaucoma in first degree relative</li> <li>c. Patients with ocular hypertension</li> <li>d. Patients postprophylactic iridotomy</li> <li>e. Patients with isolated field defects</li> <li>f. Patients with myopia</li> <li>g. Patients with optic disc drusen</li> <li>h. Patients with tilted discs</li> </ul> <p><i>Consider:</i> Risk of glaucoma diagnosis, progression of disease, waiting times, patients satisfaction, healthcare professional satisfaction.</p>	<p>7</p>
<p>7. In adult patients discharged from secondary care what is the evidence for the following interventions in facilitating safe discharge</p> <ul style="list-style-type: none"> <li>a. Provision of a patient-held record</li> <li>b. Identification of a named optometrist</li> </ul> <p><i>Consider:</i> progression of disease, patient satisfaction, healthcare professional satisfaction.</p>	<p>6.1.2 6.1.3</p>

## Annex 3

Spaeth's disc damage likelihood scale. Figure adapted from DDLS supplied by Dr Spaeth

1. Measure vertical disc diameter using slit beam height. Categorise as small, medium or large.
2. Describe narrowest rim width as ratio to disc diameter in same meridian.

THE DISC DAMAGE LIKELIHOOD SCALE						
DDLS Stage	Narrowest width of rim (rim/disc ratio)			Examples		
	For small disc <1.50 mm	For medium size disc 1.50 -2.00 mm	For large disc >2.00 mm	1.25 mm optic nerve	1.75 mm optic nerve	2.25 mm optic nerve
1	.5	.4 or more	.3 or more			
2	.4 to .49	.3 to .39	.2 to .29			
3	.3 to .39	.2 to .29	.1 to .19			
4	.2 to .29	.1 to .19	less than .1			
5	.1 to .19	less than .1	0 for less than 45°			
6	less than .1	0 for less than 45°	0 for 46° to 90°			
7	0 for less than 45°	0 for 46° to 90°	0 for 91° to 180°			
8	0 for 46° to 90°	0 for 91° to 180°	0 for 181° to 270°			
9	0 for 91° to 180°	0 for 181° to 270°	0 for more than 270°			
10	0 for more than 180°	0 for more than 270°				

### Magnification correction factors for condensing lenses

Volk 60D x0.88

Volk 66D x1.0

Volk 78D x1.2

Volk 90D x1.33

Nikon 60D x1.03

Nikon 90D x1.63

# Annex 4

## NHSScotland glaucoma referral form

Date Received:

CHI:

Hospital Number:

<b>Direct Referral To Hospital Eye Service Glaucoma</b>														
									Urgency of referral					
HOSPITAL / LOCATION CODE					HOSPITAL									
Patient Surname		Patient Forename			Title	Optometrist Details								
DOB		CHI		GENDER										
Address														
Postcode		Tel No												
Ethnicity														
Location Code:		HCP Code			Date of Referral:									
Patient History & Details					Patient Symptomatic									
					Previous Attendance at HES									
					If Yes ? Date									
					If Yes ? Location									
					Armed Forces Personnel, Immediate families and veterans					Translator Required				
					If Yes ? Language									
Disc Images					Family History of Glaucoma									
Right					Ocular Examination - External/Internal				Left					
Applanation Tonometry					Repeat Tests									
R	L	Date			R	L	Date							
Relative Afferent Pupillary Defect					R	L	Date							
Fields Attached					R	L	Date							
Corneal Pachymetry														
R	L	Date												
Vision	Sph	Cyl	Axis	VA	PH VA	Add	NVA							
R														
L														
GP informed of referral?				GP										
				GP Practice										



# Annex 5 Sample discharge letter

## NHSScotland glaucoma discharge form

Dear Optometrist,

Date: ..... / ..... / 20.....

Name:	DOB:	CHI Number
Address:	Tel:	
	Email:	

The above named patient has been discharged from .....

The findings from their last examination (date.....) are:

	Right eye		Left eye	
<b>Diagnosis and date of diagnosis</b>				
<b>Visual acuity</b>				
<b>Ocular medication</b>				
<b>Central corneal thickness</b>				
<b>Gonioscopy</b>	Open <input type="checkbox"/>	Closed <input type="checkbox"/>	Open <input type="checkbox"/>	Closed <input type="checkbox"/>
<b>Intraocular pressure (mm Hg (average of 2 measures), time; tonometer type)</b>				
<b>Glaucoma surgery or laser procedures (procedure and date)</b>				
<b>Optic nerve (Disc Damage Likelihood Scale)</b>				
Consider including digital images				
<b>Visual fields (date, technology and Global Index)</b>				
Consider including visual field plots				
<b>Comments</b> eg medication allergies/adverse reactions				

I would be grateful if you could monitor this patient at the following review interval;.....

Please re-refer if:

- intraocular pressure exceeds .....mm Hg (repeatable)
- change in optic disc appearance or
- a new repeatable visual field defect.

If you require any further information (or if at a future date you feel further glaucoma assessment is necessary) please contact .....(add tel and email)

Yours sincerely,

Discharge clinician (contact details – tel, email)

cc General Practitioner, patient

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Edinburgh Office | Gyle Square | 1 South Gyle Crescent | Edinburgh | EH12 9EB  
Telephone 0131 623 4300 Fax 0131 623 4299

Glasgow Office | Delta House | 50 West Nile Street | Glasgow | G1 2NP  
Telephone 0141 225 6999 Fax 0141 248 3776

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