



**A survey of attitudes of glaucoma subspecialists in England and Wales to visual field test intervals in relation to NICE guidelines**

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3 **A survey of attitudes of glaucoma subspecialists in England and Wales**  
4 **to visual field test intervals in relation to NICE guidelines**  
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48 **Contributorship Statement:** All authors have made a substantive intellectual  
49 contributions to this study: R Malik drafted the manuscript; H Baker carried out the  
50 analysis presented in the results and acquired the data; RA Russell was involved in  
51 the design of the study and acquiring the data; D P Crabb made substantial  
52 contributions to conception and design, revising and approving the final article.  
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## Article summary

### 1) Article Focus

- There are approximately 1 million glaucoma-related outpatient visits in the NHS annually
- Visual field (VF) testing is one of the most frequent investigations performed for monitoring patients with glaucoma and requires substantial and specialist resource utilisation
- A survey was conducted to establish attitudes to the frequency of VF testing in the UK with reference to guidelines from NICE and research recommendations

### 2) Key Messages

- Visual field monitoring intervals assigned by clinicians (for hypothetical patient scenarios) are very variable and often outside intervals recommended by NICE.
- Many specialists regard the research-recommended routine performance of 6 visual field examinations in the first 2 years as impractical in the current health setting.

### 3) Strengths and Limitations

- This is the first survey to establish the views of glaucoma subspecialists to the VF monitoring intervals for patients with glaucoma.
- The surveyed population accounted for approximately half of specialists nationally and the assumption has been made that this sample is representative of UK practice.

**ABSTRACT**

**Objectives:** To establish the attitudes of glaucoma specialists to the frequency of visual field (VF) testing in the UK, using the NICE recommendations as a standard for ideal practice.

**Design:** Prospective survey.

**Setting:** UK and Eire Glaucoma Society national meeting 2011 in Manchester, UK, with a second round of surveys administered by post.

**Participants:** 70 consultant glaucoma specialists completed the survey.

**Primary and secondary outcome measures:** (1) Compliance of assigned follow-up VF intervals with NICE guidelines for 3 hypothetical patient scenarios, with satisfactory treated intraocular pressure and (a) no evidence of VF progression; (b) evidence of VF progression and (c) uncertainty about VF progression, and respondents were asked to provide typical follow-up intervals representative of their practice; (2) Attitudes to research recommendations for 6 VF in the first 2 years for newly-diagnosed patients with glaucoma.

**Results:** For each of the clinical scenarios a, b and c, 14 (20%), 33 (47%) and 28 (40%) responses fell outside the follow-up interval recommended by NICE respectively. Nearly half of the specialists (46%) agreed that 6 VF tests in the first 2 years was ideal practice, whilst 16 (28%) said this was practice 'not possible', with many giving resources within the NHS setting as a limiting factor.

**Conclusion:** The survey highlights the large variation in attitudes to follow-up intervals for patients with glaucoma in the UK, with assigned intervals for VF testing which are, in many cases, as inconsistent with the guidelines from NICE.

## Introduction

Visual field (VF) testing, in the form of standard automated perimetry, is the most frequently performed investigation for the functional assessment of patients with primary open-angle glaucoma (POAG) in the UK.<sup>1</sup> The aim of VF testing is to detect functional deficit in patients with suspected disease and monitoring of patients with established POAG.<sup>2</sup>

The frequency of VF tests over a given period for a patient with POAG is governed by the clinician's estimate of the likelihood and speed of progression of disease, which in turn, may depend on the level of intraocular pressure (IOP) control, and stage of disease as well as other factors such as the age of the patient and degree of VF reliability. Test intervals are essentially a risk / benefit trade-off: an interval which is too long may allow timely detection of progressive VF loss to be missed whilst multiple tests at short test intervals in patients at low risk of progression may mean unnecessary extra visits and use of hospital resource. Although some published guidelines regarding the frequency of VF testing are available, these vary considerably.<sup>3,4</sup> Results from statistical modelling suggests that 6 VF tests a year (i.e. approximately one every 4 months) in newly-diagnosed patients may be necessary to allow detection of patients who may be progressing 'rapidly' in terms of VF loss.<sup>5</sup> The National Institute of Clinical Excellence (NICE) have recognised the current lack of evidence regarding the frequency of monitoring intervals for patients with POAG and recommended future research in this area of study to substantiate current practice.<sup>3</sup> Indeed, recent research has focused on the optimum number and interval between VF tests for patients.<sup>6</sup>

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3 Given that POAG accounts for a major proportion of Ophthalmology workload, with  
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5 an estimated one million outpatient visits in the UK annually,<sup>3</sup> the frequency of  
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7 testing has important implications for resource management and service delivery, as  
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9 well as cost in the outpatient setting.  
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12 We undertook a national survey to establish the attitudes of glaucoma subspecialists  
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14 to the frequency of VF testing, using the NICE recommendations as a benchmark and  
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16 also sought to investigate perceived barriers to frequent VF testing of patients with  
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18 glaucoma.  
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## 21 22 23 **Materials and Methods**

### 24 25 *Survey population*

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28 The questionnaire was administered to all UK glaucoma consultants by two methods  
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30 to ensure maximum response: 1) by hand at the UK & Eire Glaucoma Society  
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32 Meeting in December 2011 in Manchester or 2) by post in February 2012. All  
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34 responses were done by self-completion of the questionnaire and were collected  
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36 anonymously then combined to form one dataset. This study was reviewed and  
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38 approved by the City University London School of Health Science Research and Ethics  
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40 committee.  
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### 48 49 *Questionnaire design*

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51 The questionnaire consisted of 5 questions. Questions 1-3 were used to gather  
52  
53 information of the grade and location of work (England and Wales) of the responders  
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55 and to identify consultants with a subspecialist interest in glaucoma. Question 4  
56  
57 described three distinct situations designed to simulate common clinical scenarios.  
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3 For patients with POAG who were being monitored on treatment, and attending for  
4 a follow-up assessment, responders were asked to assign typical follow-up  
5 assessment intervals for a patient with IOP deemed to be at (or below) 'target IOP'  
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8 and:  
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- 10 a. No evidence of VF progression and no change in treatment
- 11 b. Evidence of VF progression and change of treatment
- 12 c. Uncertainty about VF progression and no change of treatment.

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22 These scenarios were chosen to reflect the clinical situations which have been given  
23 by NICE.<sup>3</sup> Follow-up intervals of 6 to 12 months for the first scenario and 2-6 months  
24 for the latter two have been recommended by NICE.  
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29 The last question, question 5, was open ended; specialists were asked their views  
30 about research that has suggested that all newly diagnosed patients would benefit  
31 from 6 visual field examinations (every 4 months) in the first two years of follow up  
32 from diagnosis in order to identify rapidly progressing patients.<sup>5</sup>  
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#### 40 *Data Analysis*

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43 For each of the patient scenarios in question 4, the follow-up interval given by each  
44 responder was compared to NICE recommended intervals. The proportion of  
45 responses (with either the minimum or maximum interval) lying outside the NICE  
46 recommended intervals was computed (**figure 1**).  
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52 For question 5 (whether 6 VFs should be performed in the first 2 years for newly  
53 diagnosed patients), responses were classified into 5 categories for the ease of  
54 reporting: 'agree'; 'disagree', already represents 'current practice' locally; 'not  
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3 possible'; and possible 'alternatives' to this practice and are represented in a pie-  
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5 chart (**figure 2**).  
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## 14 **Results**

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16 The questionnaire was returned by 70 Consultant Ophthalmologists currently  
17 employed in England and Wales, with a self-declared specialist interest in glaucoma.  
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20 **Figure 1** shows the follow-up intervals given by each of the responders for each of  
21 the clinical scenarios a, b and c described in question 4. For each of these, 14 (20%),  
22 33 (47%) and 28 (40%) responses fell outside the follow-up interval recommended  
23 by NICE respectively. (The width of the 95% confidence interval [CI] associated with  
24 these estimates, with n=70, is about  $\pm 12\%$ ).  
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33 Question 5 was answered by 57 out of the 70 specialists. Nearly half of these (26/57  
34 = 46%) agreed that 6 VF tests in the first 2 years was ideal practice (**figure 2**), but  
35 admitted that the practicalities of this would be challenging. Example responses that  
36 fell in this category included, *"Agree but practical issues found in a busy glaucoma  
37 clinic may be a hurdle to achieve this target."*  
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45 Two delegates (3%) indicated that this was already their current practice. Six  
46 specialists (11%) disagreed with the suggestion of 6 VF tests, whilst 16 (28%) said this  
47 was 'not possible'; again, listing limited 'capacity' or resources as a constraining  
48 factor. (The width of the 95% CI associated with these estimates, with n=57, is about  
49  $\pm 15\%$ ). Examples of responses that fell in the latter category included, *"Totally out of  
50 touch with what is possible in the current NHS clinics with such limited capacity." A  
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3 few alternatives were suggested to 6 VF tests, including alternating imaging and VF  
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5 tests for detecting progression. For example, one responder stated, *“Instead of*  
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7 *function tests, structural ones: GDX/OCT would be better..”*  
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## 10 11 12 13 14 15 16 17 18 19 **Discussion**

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21 The aim of the present study was to report the attitudes of glaucoma consultant  
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23 subspecialists in England and Wales to the frequency of VF testing for patients with  
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25 glaucoma, by exploring the designated test intervals for patients in three clinical  
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27 scenarios. We found a wide variation in designated test intervals, with respect to  
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29 NICE recommendations. This variation in attitudes is likely to reflect differences in  
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31 clinical practice, although this has yet to be established. A recent retrospective study  
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33 of 100 patients conducted at a single centre found that 89% of assigned monitoring  
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35 intervals were in accordance with NICE guidelines.<sup>7</sup>  
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43 The variation in individual attitudes to the frequency of testing is reflected in  
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45 differing recommendations for the frequency of testing in glaucoma. For example,  
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47 NICE recommend VF testing at 6-12 month intervals for a patient at target IOP and a  
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49 stable VF.<sup>3</sup> The European Glaucoma Society (EGS)<sup>3</sup> recommends three VF tests in the  
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51 first two years for a newly diagnosed patient with glaucoma, with vague guidance  
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53 thereafter.<sup>4</sup>  
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3 Given that more frequent testing is associated with a higher likelihood of identifying  
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5 progression, variations in practice with regard to the frequency of testing is likely to  
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7 imply inconsistencies in patient management and resource utilisation nationally. The  
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9 authors estimate the cost of a single VF in an NHS setting to be in excess of 50  
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11 pounds per test.<sup>8</sup> There are approximately 10,000 new cases of POAG per year. With  
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13 these estimated costs, 3 tests per year equates to a cost of 1.5 million pounds per  
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15 year for this newly diagnosed patient cohort alone. Clearly, the outpatient workload  
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17 for patients with glaucoma has substantial cost implications for the NHS.  
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24 In view of the implications of frequent testing, it is unsurprising that research has  
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26 focused on frequency and intervals of VF tests.<sup>5 6 9-12</sup> One suggested approach is to  
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28 vary the inter-test interval based on the outcome of previous tests.<sup>11 12</sup> Most of this  
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30 research has recommended increasing the frequency of VF testing to ensure better  
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32 sensitivity in diagnosing progression, without perhaps considering the cost/benefit  
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34 ratio, or problems with false positive detection in the presence of increased testing.  
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36 One recent study proposed multiple tests at the start and end of a fixed  
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38 'observation' period, for more reliable identification of progressing patients.<sup>6</sup>  
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45 It is interesting that 3 VF tests annually, the number which may be required to detect  
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47 'rapidly' progressing patients and consistent with the number recommended by NICE  
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49 for patients with suboptimal IOP and evidence of progression, was seen as  
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51 impractical by many UK ophthalmologists with a specialist interest in glaucoma in  
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53 terms of availability of hospital resources. It would seem that the potential utility of  
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55 UK ophthalmology departments to perform the number of VFs to meet clinical  
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3 guidelines needs further investigation. Whilst outsourcing visits to a community  
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5 setting may lighten the hospital burden, this may have overall adverse cost  
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7 implications.<sup>13</sup> Further discussion of issues about service delivery for glaucoma  
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9 management is beyond the scope of this report. One possible approach to increasing  
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11 diagnostic power to detect progression in the face of a limited number of VF tests is  
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13 to use alternative technology, in addition to VF testing for monitoring, such as optic  
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15 nerve head imaging. Several methods have recently been suggested for integrating  
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17 structural and functional tests for glaucoma progression<sup>14-16</sup> and the use of an  
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19 additional diagnostic modality leads to greater accuracy for detecting progression  
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21 than VF tests alone.<sup>15</sup> It remains to be seen if these research ideas can translate to  
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23 clinical practice.  
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29 A limitation of this and all studies of this nature is the response rate. An assumption  
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31 has been made that responses from the surveyed consultants is representative of  
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33 subspecialist national practice in England and Wales. There are approximately 150  
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35 Consultant Ophthalmologists in the England and Wales with a glaucoma  
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37 subspecialist interest as estimated from a list obtained from the Royal College of  
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39 Ophthalmologists. Our surveyed population would therefore represent nearly half of  
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41 glaucoma specialists nationally.  
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46 In conclusion, the variable attitudes of ophthalmologists with a glaucoma  
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48 subspecialty to the frequency of VF testing in England and Wales highlights the need  
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50 for further research in this area to, firstly establish current practice and, secondly  
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52 provide a firmer evidence base for designated VF test intervals. The longer term goal  
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54 would be to ensure optimal resource utilisation and a consistent, high standard of  
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56 practice nationally  
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**Competing Interests**

None of the authors have competing interests relevant to this work

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**Data sharing statement**

Additional data, regarding the exact responses given by the specialists to the survey can be obtained by request from the corresponding author (DPC).

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50 **Figure 1:** Responses from 70 Consultant Ophthalmologists with a declared  
51 subspecialist interest in glaucoma, giving minimum (lower error bars) and maximum  
52 (upper error bars) follow-up interval for a hypothetical patient with IOP at 'target'  
53 and **(a)** no evidence of visual field progression and no change in treatment; **(b)**  
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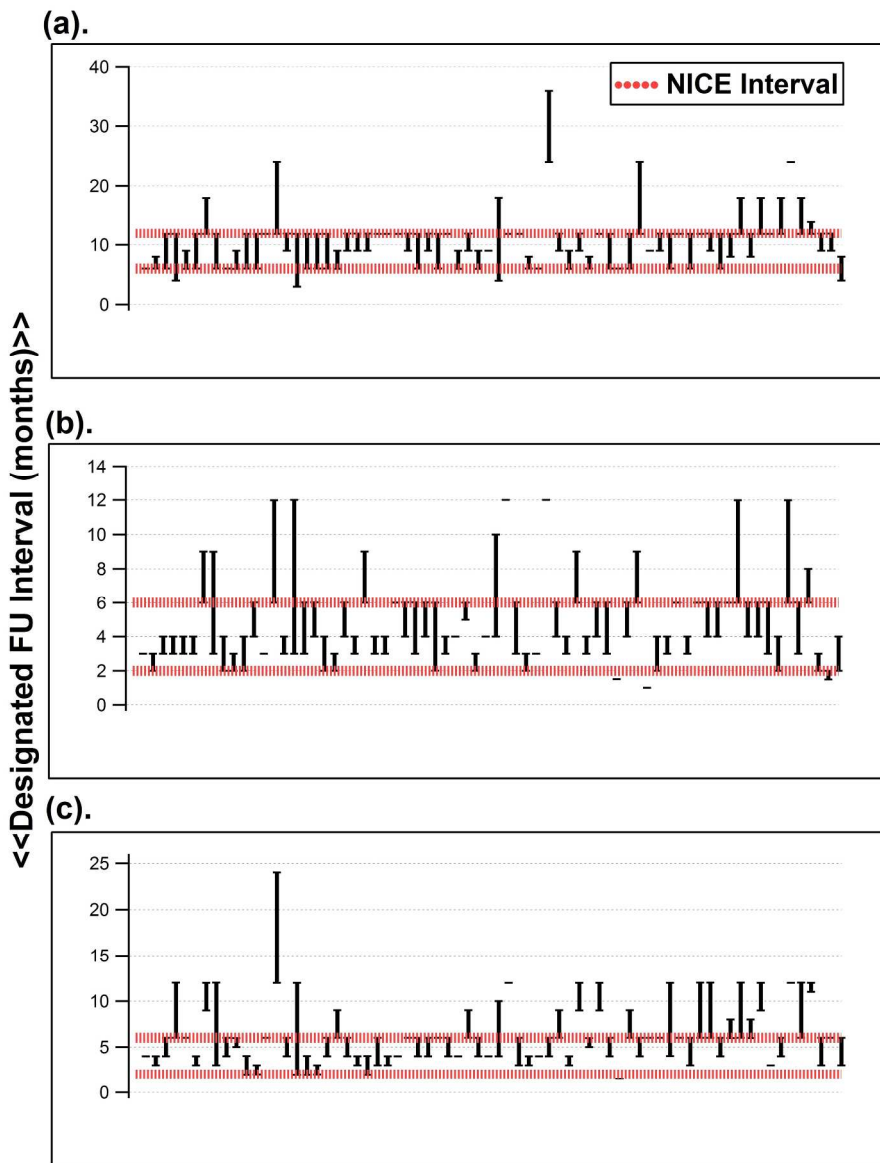
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7 values for which only a single interval was given by respondents, without specifying  
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51 **Figure 2:** Summary of views of responders to the suggestion that 6 visual field tests  
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53 should be performed in the first 2 years for a newly-diagnosed patient with POAG  
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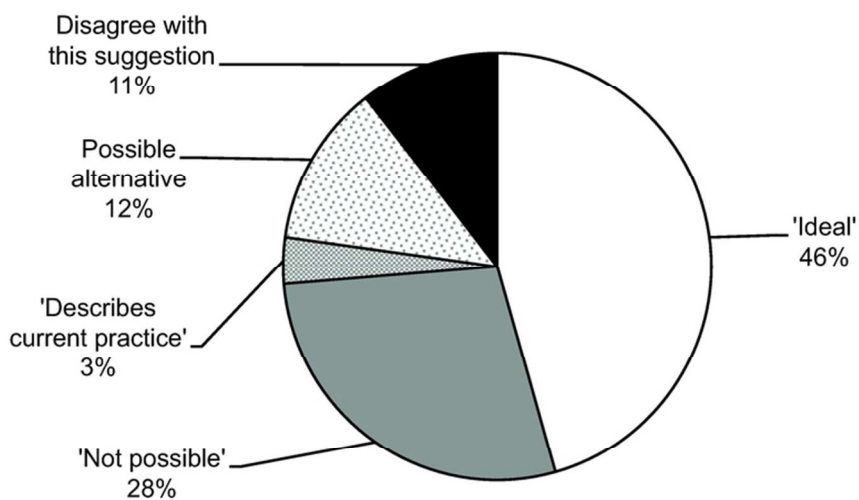
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Responses from 70 Consultant Ophthalmologists with a declared subspecialist interest in glaucoma, giving minimum (lower error bars) and maximum (upper error bars) follow-up interval for a hypothetical patient with IOP at 'target' and (a) no evidence of visual field progression and no change in treatment; (b) evidence of visual field progression and no change in treatment; (c) uncertainty about visual field progression and no change in treatment. Single bars represent values for which only a single interval was given by respondents, without specifying the minimum / maximum monitoring interval.

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: Summary of views of responders to the suggestion that 6 visual field tests should be performed in the first 2 years for a newly-diagnosed patient with POAG  
76x41mm (300 x 300 DPI)

review only



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Keywords:	NICE recommendations, Survey, Primary open angle glaucoma, Visual fields

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3 1 **A survey of attitudes of glaucoma subspecialists in England and Wales**  
4 2 **to visual field test intervals in relation to NICE guidelines**  
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8 5 Rizwan Malik,<sup>1</sup> Helen Baker,<sup>1,2</sup> Richard A Russell,<sup>1,2</sup> and David P Crabb<sup>2</sup>  
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20 17  
21 18 **Short / running title:** Attitudes to visual field test intervals  
22 19

23 20 **Keywords:** NICE recommendations  
24 21 Survey  
25 22 Primary open-angle glaucoma  
26 23 Visual fields  
27 24  
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3 44 **Article summary**  
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5 45 **1) Article Focus**  
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7 46 - There are approximately 1 million glaucoma-related outpatient visits in the NHS  
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9 47 annually  
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11 48 - Visual field (VF) testing is one of the most frequent investigations performed for  
12

13 49 monitoring patients with glaucoma and requires substantial and specialist resource  
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15 50 utilisation  
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17 51 - A survey was conducted to establish attitudes to the frequency of VF testing in the  
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19 52 UK with reference to guidelines from NICE and research recommendations  
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21 53 **2) Key Messages**  
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23 54 - Visual field monitoring intervals assigned by clinicians (for hypothetical patient  
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25 55 scenarios) are very variable and often outside intervals recommended by NICE.  
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27 56 - Many specialists regard the research-recommended routine performance of 6  
28

29 57 visual field examinations in the first 2 years as impractical in the current health  
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31 58 setting.  
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33 59 **3) Strengths and Limitations**  
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35 60 - This is the first survey to establish the views of glaucoma subspecialists to the VF  
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37 61 monitoring intervals for patients with glaucoma.  
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39 62 - The surveyed population accounted for approximately half of specialists nationally  
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41 63 and the assumption has been made that this sample is representative of UK practice.  
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3 68 **ABSTRACT**  
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5 69 **Objectives:** To establish the attitudes of glaucoma specialists to the frequency of  
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7 70 visual field (VF) testing in the UK, using the NICE recommendations as a standard for  
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9 71 ideal practice.

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12 72 **Design:** Interview and postal survey.

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14 73 **Setting:** UK and Eire Glaucoma Society national meeting 2011 in Manchester, UK,  
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16 74 with a second round of surveys administered by post.

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19 75 **Participants:** All consultant glaucoma specialists in England and Wales were invited  
20  
21 76 to complete the survey.

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23 77 **Primary and secondary outcome measures:** (1) Compliance of assigned follow-up VF  
24  
25 78 intervals with NICE guidelines for 3 hypothetical patient scenarios, with satisfactory  
26  
27 79 treated intraocular pressure and (a) no evidence of VF progression; (b) evidence of  
28  
29 80 VF progression and (c) uncertainty about VF progression, and respondents were  
30  
31 81 asked to provide typical follow-up intervals representative of their practice; (2)  
32  
33 82 Attitudes to research recommendations for 6 VF in the first 2 years for newly-  
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35 83 diagnosed patients with glaucoma.

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37 84 **Results:** Seventy glaucoma specialists completed the survey. For each of the clinical  
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39 85 scenarios a, b and c, 14 (20%), 33 (47%) and 28 (40%) responses fell outside the  
40  
41 86 follow-up interval recommended by NICE respectively. Nearly half of the specialists  
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43 87 (46%) agreed that 6 VF tests in the first 2 years was ideal practice, whilst 16 (28%)  
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45 88 said this was practice 'not possible', with many giving resources within the NHS  
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47 89 setting as a limiting factor.

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50 90 **Conclusion:** The results from this survey suggests that there is a large variation in  
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52 91 attitudes to follow-up intervals for patients with glaucoma in the UK, with assigned  
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3 92 intervals for VF testing which are, in many cases, as inconsistent with the guidelines  
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5 93 from NICE.  
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## 9 95 **Introduction**

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11 97 Visual field (VF) testing, in the form of standard automated perimetry, is the most  
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13 98 frequently performed investigation for the functional assessment of patients with  
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15 99 primary open-angle glaucoma (POAG) in the UK.<sup>1</sup> The aim of VF testing is to detect  
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18 100 functional deficit in patients with suspected disease and monitoring of patients with  
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21 101 established POAG.<sup>2</sup>

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23 102 The frequency of VF tests over a given period for a patient with POAG is governed by  
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25 103 the clinician's estimate of the likelihood and speed of progression of disease, which  
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27 104 in turn, may depend on the level of intraocular pressure (IOP) control, and stage of  
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29 105 disease as well as other factors such as the age of the patient and degree of VF  
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32 106 reliability. Test intervals are essentially a risk / benefit trade-off: an interval which is  
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34 107 too long may allow timely detection of progressive VF loss to be missed whilst  
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36 108 multiple tests at short test intervals in patients at low risk of progression may mean  
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38 109 unnecessary extra visits and use of hospital resource. Although some published  
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40 110 guidelines regarding the frequency of VF testing are available, these vary  
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42 111 considerably.<sup>3,4</sup> Results from statistical modelling suggests that 6 VF tests in two  
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44 112 years (i.e. approximately one every 4 months) in newly-diagnosed patients may be  
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47 113 necessary to allow detection of patients who may be progressing 'rapidly' in terms of  
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49 114 VF loss.<sup>5</sup> The National Institute of Clinical Excellence (NICE) have recognised the  
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51 115 current lack of evidence regarding the frequency of monitoring intervals for patients  
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54 116 with POAG and recommended future research in this area of study to substantiate  
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3 117 current practice.<sup>3</sup> Indeed, recent research has focused on the optimum number and  
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5 118 interval between VF tests for patients.<sup>6</sup>  
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10 120 Given that POAG accounts for a major proportion of Ophthalmology workload, with  
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12 121 an estimated one million outpatient visits in the UK annually,<sup>3</sup> the frequency of  
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14 122 testing has important implications for resource management and service delivery, as  
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16 123 well as cost in the outpatient setting.  
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19 124 We undertook a national survey to establish the attitudes of glaucoma subspecialists  
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21 125 to the frequency of VF testing, using the NICE recommendations as a benchmark and  
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23 126 also sought to investigate perceived barriers to frequent VF testing of patients with  
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25 127 glaucoma.  
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### 30 31 129 **Materials and Methods**

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33 130 The current study was undertaken as part of a larger National Institute for Health  
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35 131 Research (NIHR-) funded project to evaluate factors governing VF test intervals in  
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37 132 clinical practice. The current study was needed in order to infer the extent to which  
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39 133 actual VF intervals and frequency (investigated in a national audit of practice) may  
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41 134 be influenced by the attitude of clinicians.  
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#### 46 47 136 *Survey population*

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49 137 The questionnaire was administered to all UK glaucoma consultants by two methods  
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51 138 to ensure maximum response: 1) by hand at the UK & Eire Glaucoma Society  
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53 139 (UKEGS) Meeting in December 2011 in Manchester or 2) by post, with a self-  
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55 140 addressed prepaid envelope, in February 2012. All responses were done by self-  
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3 141 completion of the questionnaire and were collected anonymously then combined to  
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5 142 form one dataset. All glaucoma specialists, identified from a list provided by the  
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7 143 Royal College of Ophthalmologists (n=150), were sent the postal survey. Specialists  
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9 144 who had previously completed the survey at the UKEGS were requested not to  
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11 145 respond again. This study was reviewed and approved by the City University London  
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13 146 School of Health Science Research and Ethics committee.  
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148 *Questionnaire design*

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22 149 The questionnaire consisted of 5 questions. Questions 1-3 were used to gather  
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24 150 information of the grade and location of work (England and Wales) of the responders  
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26 151 and to identify consultants with a subspecialist interest in glaucoma. Question 4  
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28 152 described three distinct situations designed to simulate common clinical scenarios.  
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30 153 For patients with POAG who were being monitored on treatment, and attending for  
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32 154 a follow-up assessment, responders were asked to assign typical follow-up  
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34 155 assessment intervals for a patient with IOP deemed to be at (or below) 'target IOP'  
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36 156 and:  
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41 157 a. No evidence of VF progression and no change in treatment  
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43 158 b. Evidence of VF progression and change of treatment  
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45 159 c. Uncertainty about VF progression and no change of treatment.  
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51 161 These scenarios were chosen to reflect the clinical situations which have been given  
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53 162 by NICE.<sup>3</sup> Follow-up intervals of 6 to 12 months for the first scenario and 2-6 months  
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55 163 for the latter two have been recommended by NICE.  
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3 164 The last question, question 5, was open ended; specialists were asked their views  
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5 165 about research that has suggested that all newly diagnosed patients would benefit  
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7 166 from 6 visual field examinations (every 4 months) in the first two years of follow up  
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9 167 from diagnosis in order to identify rapidly progressing patients. <sup>5</sup>  
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#### 14 169 *Data Analysis*

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17 170 For each of the patient scenarios in question 4, the follow-up interval given by each  
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19 171 responder was compared to NICE recommended intervals. The proportion of  
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21 172 responses (with either the minimum or maximum interval) lying outside the NICE  
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23 173 recommended intervals was computed (**figure 1**).  
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26 174 For question 5 (whether 6 VFs should be performed in the first 2 years for newly  
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28 175 diagnosed patients), responses were classified into 5 categories for the ease of  
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30 176 reporting: 'agree'; 'disagree', already represents 'current practice' locally; 'not  
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32 177 possible'; and possible 'alternatives' to this practice and are represented in a pie-  
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34 178 chart (**figure 2**).  
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#### 45 182 **Results**

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47 183 The questionnaire was returned by 70 Consultant Ophthalmologists currently  
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49 184 employed in England and Wales, with a self-declared specialist interest in glaucoma.  
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51 185 From the conference, responses were obtained from 28 specialists. The remainder of  
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53 186 the responses (42) were received through the postal survey. **Figure 1** shows the  
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55 187 follow-up intervals given by each of the responders for each of the clinical scenarios  
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3 188 a, b and c described in question 4. For each of these, 14 (20%), 33 (47%) and 28  
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5 189 (40%) responses fell outside the follow-up interval recommended by NICE  
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7 190 respectively. (The width of the 95% confidence interval [CI] associated with these  
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9 191 estimates, with n=70, is about  $\pm 12\%$ ).

12 192 Question 5 was answered by 57 out of the 70 specialists. Nearly half of these (26/57  
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14 193 = 46%) agreed that 6 VF tests in the first 2 years was ideal practice (**figure 2**), but  
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16 194 admitted that the practicalities of this would be challenging. Example responses that  
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18 195 fell in this category included, *"Agree but practical issues found in a busy glaucoma  
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20 196 clinic may be a hurdle to achieve this target."*

24 197 Two delegates (3%) indicated that this was already their current practice. Six  
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26 198 specialists (11%) disagreed with the suggestion of 6 VF tests, whilst 16 (28%) said this  
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28 199 was 'not possible'; again, listing limited 'capacity' or resources as a constraining  
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30 200 factor. (The width of the 95% CI associated with these estimates, with n=57, is about  
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32 201  $\pm 15\%$ ). Examples of responses that fell in the latter category included, *"Totally out of  
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34 202 touch with what is possible in the current NHS clinics with such limited capacity."* A  
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36 203 few alternatives were suggested to 6 VF tests, including alternating imaging and VF  
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38 204 tests for detecting progression. For example, one responder stated, *"Instead of  
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40 205 function tests, structural ones: GDX/OCT would be better.."*

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45 210 **Discussion**

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3 212 The aim of the present study was to report the attitudes of glaucoma consultant  
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5 213 subspecialists in England and Wales to the frequency of VF testing for patients with  
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7 214 glaucoma, by exploring the designated test intervals for patients in three clinical  
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9 215 scenarios. The hypothesis was that clinicians would be fully-compliant to NICE  
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11 216 guidelines in their attitudes to intervals for VF testing. However, the results of the  
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13 217 survey disprove this hypothesis. We found a wide variation in designated test  
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15 218 intervals, with respect to NICE recommendations. This variation in attitudes is likely  
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17 219 to reflect differences in clinical practice, although this has yet to be established. A  
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19 220 recent retrospective study of 100 patients conducted at a single centre found that  
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21 221 89% of assigned monitoring intervals were in accordance with NICE guidelines.<sup>7</sup>  
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29 223 The variation in individual attitudes to the frequency of testing is reflected in  
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31 224 differing recommendations for the frequency of testing in glaucoma. For example,  
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33 225 NICE recommend VF testing at 6-12 month intervals for a patient at target IOP and a  
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35 226 stable VF.<sup>3</sup> The European Glaucoma Society (EGS) recommends three VF tests in the  
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37 227 first two years for a newly diagnosed patient with glaucoma, with vague guidance  
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39 228 thereafter.<sup>4</sup>  
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45 230 Given that more frequent testing is associated with a higher likelihood of identifying  
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47 231 progression, variations in practice with regard to the frequency of testing is likely to  
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49 232 imply inconsistencies in patient management and resource utilisation nationally. The  
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51 233 authors estimate the cost of a single VF in an NHS setting to be in excess of 50  
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53 234 pounds per test.<sup>8</sup> There are approximately 10,000 new cases of POAG per year. With  
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55 235 these estimated costs, 3 tests per year equates to a cost of 1.5 million pounds per  
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3 236 year for this newly diagnosed patient cohort alone. Clearly, the outpatient workload  
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5 237 for patients with glaucoma has substantial cost implications for the NHS.  
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10 239 In view of the implications of frequent testing, it is unsurprising that research has  
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12 240 focused on frequency and intervals of VF tests.<sup>5 6 9-12</sup> One suggested approach is to

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14 241 vary the inter-test interval based on the outcome of previous tests.<sup>11 12</sup> Most of this

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17 242 research has recommended increasing the frequency of VF testing to ensure better

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19 243 sensitivity in diagnosing progression, without perhaps considering the cost/benefit

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21 244 ratio, or problems with false positive detection in the presence of increased testing.

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23 245 One recent study proposed multiple tests at the start and end of a fixed

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25 246 'observation' period, for more reliable identification of progressing patients.<sup>6</sup>  
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31 248 It is interesting that 3 VF tests annually, the number which may be required to detect

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33 249 'rapidly' progressing patients and consistent with the number recommended by NICE

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35 250 for patients with suboptimal IOP and evidence of progression, was seen as

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37 251 impractical by many UK ophthalmologists with a specialist interest in glaucoma in

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39 252 terms of availability of hospital resources. It would seem that the potential utility of

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41 253 UK ophthalmology departments to perform the number of VFs to meet clinical

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43 254 guidelines needs further investigation. Whilst outsourcing visits to a community

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45 255 setting may lighten the hospital burden, this may have overall adverse cost

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47 256 implications.<sup>13</sup> Further discussion of issues about service delivery for glaucoma

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49 257 management is beyond the scope of this report. One possible approach to increasing

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51 258 diagnostic power to detect progression in the face of a limited number of VF tests is

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53 259 to use alternative technology, in addition to VF testing for monitoring, such as optic  
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3 260 nerve head imaging. Several methods have recently been suggested for integrating  
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5 261 structural and functional tests for glaucoma progression<sup>14-16</sup> and the use of an  
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7 262 additional diagnostic modality leads to greater accuracy for detecting progression  
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10 263 than VF tests alone.<sup>15</sup> It remains to be seen if these research ideas can translate to  
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12 264 clinical practice.

14 265 A limitation of this and all studies of this nature is the response rate. An assumption  
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17 266 has been made that responses from the surveyed consultants is representative of  
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19 267 subspecialist national practice in England and Wales. There are approximately 150  
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21 268 Consultant Ophthalmologists in the England and Wales with a glaucoma  
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23 269 subspecialist interest as estimated from a list obtained from the Royal College of  
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25 270 Ophthalmologists. Our surveyed population would therefore represent nearly half of  
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27 271 glaucoma specialists nationally. Further, the assumption has been made that the  
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29 272 method of survey delivery (conference or postal) has not influenced responses from  
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31 273 participants and the responses have been combined for reporting.

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33 274 Responses to question 5 were classified into distinct categories for ease of  
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35 275 interpretation, by only one of the investigators (HB). As the responses were generally  
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37 276 non-ambiguous, it is unlikely that subjectivity contributed to misclassification of  
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39 277 responses. The survey used was developed by consensus between scientists in vision  
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41 278 research, psychology and ophthalmologists and is not a validated tool for assessing  
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43 279 attitudes for VF testing.

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45 280 In conclusion, the variable attitudes of ophthalmologists with a glaucoma  
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47 281 subspecialty to the frequency of VF testing in England and Wales highlights the need  
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49 282 for further research in this area to, firstly establish current practice and, secondly  
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51 283 provide a firmer evidence base for designated VF test intervals. The longer term goal  
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3 284 would be to ensure optimal resource utilisation and a consistent, high standard of  
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5 285 practice nationally  
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### 287 **Competing Interests**

11  
12 288 None of the authors have competing interests relevant to this work  
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15 289

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25 294 Moorfields Eye Hospital NHS Foundation Trust and UCL Institute of Ophthalmology.  
26  
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3 308 **Data sharing statement**  
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5 309 Additional data, regarding the exact responses given by the specialists to the survey  
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7 310 can be obtained by request from the corresponding author (DPC).  
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11  
12 312 **Contributorship Statement:** All authors have made a substantive intellectual  
13

14  
15 313 contributions to this study: R Malik drafted the manuscript; H Baker carried out the  
16

17 314 analysis presented in the results and acquired the data; RA Russell was involved in  
18

19 315 the design of the study and acquiring the data; D P Crabb made substantial  
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21 316 contributions to conception and design, revising and approving the final article.  
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3 379 **Figure legends:**  
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5 380 **Figure 1:** Responses from 70 Consultant Ophthalmologists with a declared  
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7 381 subspecialist interest in glaucoma, giving minimum (lower error bars) and maximum  
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9 382 (upper error bars) follow-up interval for a hypothetical patient with IOP at 'target'  
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11 383 and **(a)** no evidence of visual field progression and no change in treatment; **(b)**  
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13 384 evidence of visual field progression and no change in treatment; **(c)** uncertainty  
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15 385 about visual field progression and no change in treatment. Single bars represent  
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17 386 values for which only a single interval was given by respondents, without specifying  
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19 387 the minimum / maximum monitoring interval.  
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24 388 **Figure 2:** Summary of views of responders to the suggestion that 6 visual field tests  
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26 389 should be performed in the first 2 years for a newly-diagnosed patient with POAG  
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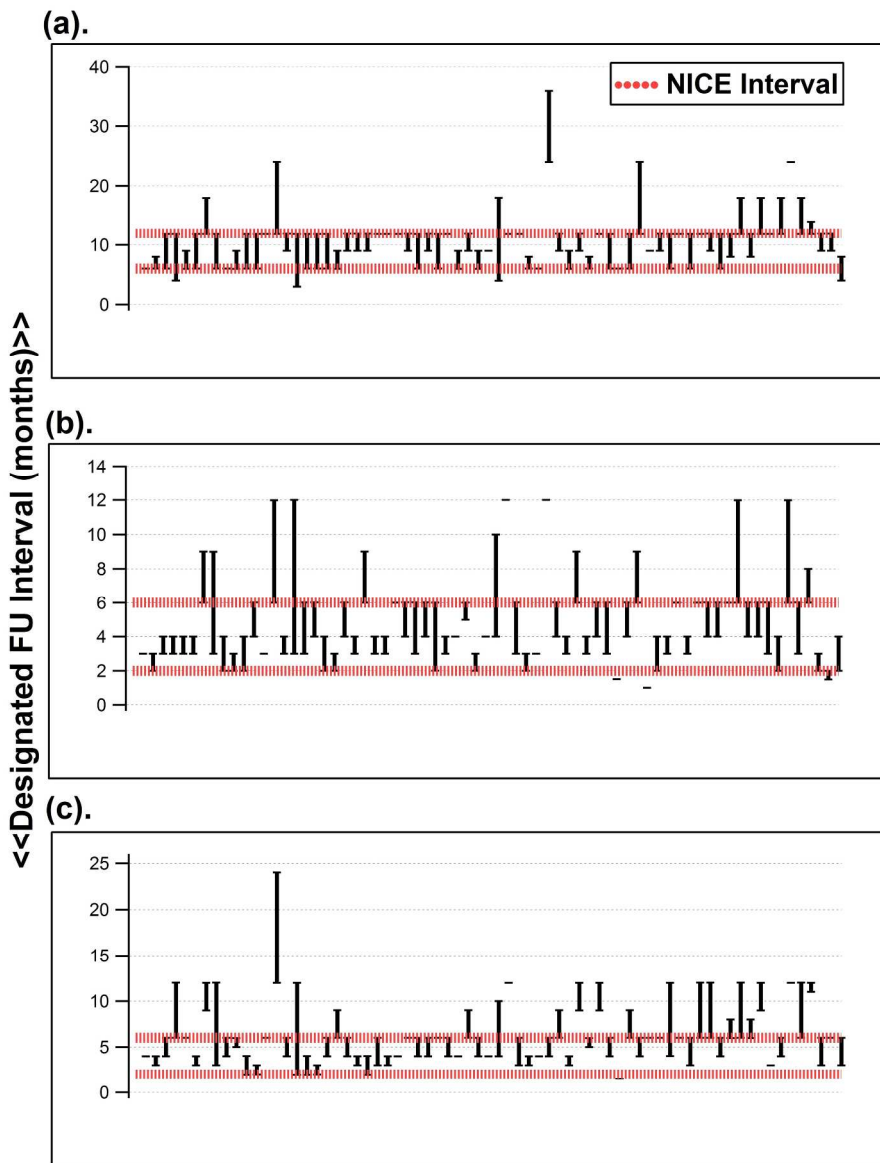
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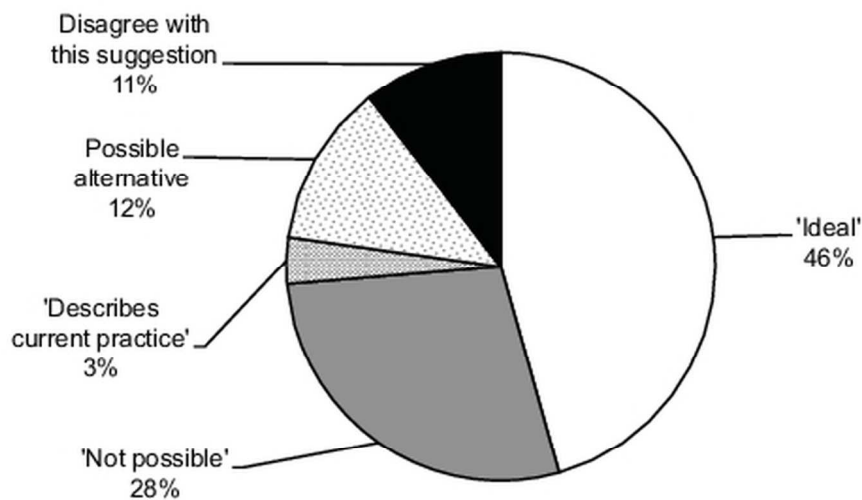
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Responses from 70 Consultant Ophthalmologists with a declared subspecialist interest in glaucoma, giving minimum (lower error bars) and maximum (upper error bars) follow-up interval for a hypothetical patient with IOP at 'target' and (a) no evidence of visual field progression and no change in treatment; (b) evidence of visual field progression and no change in treatment; (c) uncertainty about visual field progression and no change in treatment. Single bars represent values for which only a single interval was given by respondents, without specifying the minimum / maximum monitoring interval.

214x288mm (300 x 300 DPI)



: Summary of views of responders to the suggestion that 6 visual field tests should be performed in the first 2 years for a newly-diagnosed patient with POAG  
 166x90mm (300 x 300 DPI)

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6 | **A survey of attitudes of glaucoma subspecialists in England and Wales**  
7 **to visual field test intervals in relation to NICE guidelines**  
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Formatted: Numbering: Continuous

11 Rizwan Malik,<sup>1</sup> Helen Baker,<sup>1,2</sup> Richard A Russell,<sup>1,2</sup> and David P Crabb<sup>2</sup>

- 12  
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14 Moorfields Eye Hospital Foundation NHS Trust  
15 & UCL Institute of Ophthalmology  
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24 **Short / running title:** Attitudes to visual field test intervals  
25

26 **Keywords:** NICE recommendations  
27 Survey  
28 Primary open-angle glaucoma  
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45  
46

47 contributions to this study: R Malik drafted the manuscript; H Baker carried out the  
48 analysis presented in the results and acquired the data; RA Russell was involved in  
49 the design of the study and acquiring the data; D P Crabb made substantial  
50 contributions to conception and design, revising and approving the final article.  
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**ABSTRACT**

**Objectives:** To establish the attitudes of glaucoma specialists to the frequency of visual field (VF) testing in the UK, using the NICE recommendations as a standard for ideal practice.

**Design:** ~~Interview and postal~~ Prospective survey.

**Setting:** UK and Eire Glaucoma Society national meeting 2011 in Manchester, UK, with a second round of surveys administered by post.

**Participants:** ~~All 70~~ consultant glaucoma specialists in England and Wales were invited to completed the survey.

**Primary and secondary outcome measures:** (1) Compliance of assigned follow-up VF intervals with NICE guidelines for 3 hypothetical patient scenarios, with satisfactory treated intraocular pressure and (a) no evidence of VF progression; (b) evidence of VF progression and (c) uncertainty about VF progression, and respondents were asked to provide typical follow-up intervals representative of their practice; (2) Attitudes to research recommendations for 6 VF in the first 2 years for newly-diagnosed patients with glaucoma.

**Results:** ~~70~~ Seventy subglaucoma specialists completed the survey. For each of the clinical scenarios a, b and c, 14 (20%), 33 (47%) and 28 (40%) responses fell outside the follow-up interval recommended by NICE respectively. Nearly half of the specialists (46%) agreed that 6 VF tests in the first 2 years was ideal practice, whilst 16 (28%) said this was practice 'not possible', with many giving resources within the NHS setting as a limiting factor.

**Conclusion:** The results from this survey suggests that there is ~~highlights at~~ large variation in attitudes to follow-up intervals for patients with glaucoma in the UK,



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6 68 with assigned intervals for VF testing which are, in many cases, as inconsistent with  
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8 69 the guidelines from NICE.  
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11 71 **Introduction**

12 72  
13 73 Visual field (VF) testing, in the form of standard automated perimetry, is the most  
14  
15 74 frequently performed investigation for the functional assessment of patients with  
16  
17 75 primary open-angle glaucoma (POAG) in the UK.<sup>1</sup> The aim of VF testing is to detect  
18  
19 76 functional deficit in patients with suspected disease and monitoring of patients with  
20  
21 77 established POAG.<sup>2</sup>

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24 78 The frequency of VF tests over a given period for a patient with POAG is governed by  
25  
26 79 the clinician's estimate of the likelihood and speed of progression of disease, which  
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28 80 in turn, may depend on the level of intraocular pressure (IOP) control, and stage of  
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30 81 disease as well as other factors such as the age of the patient and degree of VF  
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32 82 reliability. Test intervals are essentially a risk / benefit trade-off: an interval which is  
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34 83 too long may allow timely detection of progressive VF loss to be missed whilst  
35  
36 84 multiple tests at short test intervals in patients at low risk of progression may mean  
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38 85 unnecessary extra visits and use of hospital resource. Although some published  
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40 86 guidelines regarding the frequency of VF testing are available, these vary

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43 87 considerably.<sup>3,4</sup> Results from statistical modelling suggests that 6 VF tests in two  
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45 88 years (i.e. approximately one every 4 months) in newly-diagnosed patients may be  
46  
47 89 necessary to allow detection of patients who may be progressing 'rapidly' in terms of  
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49 90 VF loss.<sup>5</sup> The National Institute of Clinical Excellence (NICE) have recognised the  
50  
51 91 current lack of evidence regarding the frequency of monitoring intervals for patients  
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53 92 with POAG and recommended future research in this area of study to substantiate  
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93 current practice.<sup>3</sup> Indeed, recent research has focused on the optimum number and  
94 interval between VF tests for patients.<sup>6</sup>

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96 Given that POAG accounts for a major proportion of Ophthalmology workload, with  
97 an estimated one million outpatient visits in the UK annually,<sup>3</sup> the frequency of  
98 testing has important implications for resource management and service delivery, as  
99 well as cost in the outpatient setting.

100 We undertook a national survey to establish the attitudes of glaucoma subspecialists  
101 to the frequency of VF testing, using the NICE recommendations as a benchmark and  
102 also sought to investigate perceived barriers to frequent VF testing of patients with  
103 glaucoma.

104

## 105 **Materials and Methods**

106 [The current study was undertaken as part of a larger National Institute for Health  
107 Research \(NIHR-\) funded project to evaluate factors governing VF test intervals in  
108 clinical practice. The current study was needed in order to infer the extent to which  
109 actual VF intervals and frequency \(investigated in a national audit of practice\) may  
110 be influenced by the attitude of clinicians.](#)

111

### 112 *Survey population*

113 The questionnaire was administered to all UK glaucoma consultants by two methods  
114 to ensure maximum response: 1) by hand at the UK & Eire Glaucoma Society  
115 ([UKEGS](#)) Meeting in December 2011 in Manchester or 2) by post, [with a self-  
116 addressed prepaid envelope](#), in February 2012. All responses were done by self-

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6 117 completion of the questionnaire and were collected anonymously then combined to  
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8 118 form one dataset. [All glaucoma specialists, identified from a list provided by the](#)  
9  
10 119 [Royal College of Ophthalmologists \(n=150\), were sent the postal survey. Specialists](#)  
11  
12 120 [who had previously completed the survey at the UKEGS were requested not to](#)  
13  
14 121 [respond again.](#) This study was reviewed and approved by the City University London  
15  
16  
17 122 School of Health Science Research and Ethics committee.  
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### 23 124 *Questionnaire design*

24 125 The questionnaire consisted of 5 questions. Questions 1-3 were used to gather  
25  
26 126 information of the grade and location of work (England and Wales) of the responders  
27  
28 127 and to identify consultants with a subspecialist interest in glaucoma. Question 4  
29  
30 128 described three distinct situations designed to simulate common clinical scenarios.  
31  
32 129 For patients with POAG who were being monitored on treatment, and attending for  
33  
34 130 a follow-up assessment, responders were asked to assign typical follow-up  
35  
36 131 assessment intervals for a patient with IOP deemed to be at (or below) 'target IOP'  
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38 132 and:

- 39  
40 133 a. No evidence of VF progression and no change in treatment
- 41  
42 134 b. Evidence of VF progression and change of treatment
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44 135 c. Uncertainty about VF progression and no change of treatment.

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48 137 These scenarios were chosen to reflect the clinical situations which have been given  
49  
50 138 by NICE.<sup>3</sup> Follow-up intervals of 6 to 12 months for the first scenario and 2-6 months  
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52 139 for the latter two have been recommended by NICE.  
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6 140 The last question, question 5, was open ended; specialists were asked their views  
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8 141 about research that has suggested that all newly diagnosed patients would benefit  
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10 142 from 6 visual field examinations (every 4 months) in the first two years of follow up  
11  
12 143 from diagnosis in order to identify rapidly progressing patients.<sup>5</sup>  
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14

#### 15 16 17 145 *Data Analysis*

18  
19 146 For each of the patient scenarios in question 4, the follow-up interval given by each  
20  
21 147 responder was compared to NICE recommended intervals. The proportion of  
22  
23 148 responses (with either the minimum or maximum interval) lying outside the NICE  
24  
25 149 recommended intervals was computed (**figure 1**).

26  
27 150 For question 5 (whether 6 VFs should be performed in the first 2 years for newly  
28  
29 151 diagnosed patients), responses were classified into 5 categories for the ease of  
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31 152 reporting: 'agree'; 'disagree', already represents 'current practice' locally; 'not  
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33 153 possible'; and possible 'alternatives' to this practice and are represented in a pie-  
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35 154 chart (**figure 2**).

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#### 42 43 158 **Results**

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45 159 The questionnaire was returned by 70 Consultant Ophthalmologists currently  
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47 160 employed in England and Wales, with a self-declared specialist interest in glaucoma.

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50 161 [From the conference, responses were obtained from 28 specialists. The remainder of](#)  
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52 162 [the responses \(42\) were received through the postal survey.](#)  
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6 163 **Figure 1** shows the follow-up intervals given by each of the responders for each of  
7  
8 164 the clinical scenarios a, b and c described in question 4. For each of these, 14 (20%),  
9  
10 165 33 (47%) and 28 (40%) responses fell outside the follow-up interval recommended  
11  
12 166 by NICE respectively. (The width of the 95% confidence interval [CI] associated with  
13  
14 167 these estimates, with n=70, is about  $\pm 12\%$ ).

15  
16 168 Question 5 was answered by 57 out of the 70 specialists. Nearly half of these (26/57  
17  
18 169 = 46%) agreed that 6 VF tests in the first 2 years was ideal practice (**figure 2**), but  
19  
20 170 admitted that the practicalities of this would be challenging. Example responses that  
21  
22 171 fell in this category included, *"Agree but practical issues found in a busy glaucoma*  
23  
24 172 *clinic may be a hurdle to achieve this target."*

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26 173 Two delegates (3%) indicated that this was already their current practice. Six  
27  
28 174 specialists (11%) disagreed with the suggestion of 6 VF tests, whilst 16 (28%) said this  
29  
30 175 was 'not possible'; again, listing limited 'capacity' or resources as a constraining  
31  
32 176 factor. (The width of the 95% CI associated with these estimates, with n=57, is about  
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34 177  $\pm 15\%$ ). Examples of responses that fell in the latter category included, *"Totally out of*  
35  
36 178 *touch with what is possible in the current NHS clinics with such limited capacity."* A  
37  
38 179 few alternatives were suggested to 6 VF tests, including alternating imaging and VF  
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40 180 tests for detecting progression. For example, one responder stated, *"Instead of*  
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42 181 *function tests, structural ones: GDX/OCT would be better.."*

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54 186 **Discussion**

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7 188 The aim of the present study was to report the attitudes of glaucoma consultant  
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9 189 subspecialists in England and Wales to the frequency of VF testing for patients with  
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11 190 glaucoma, by exploring the designated test intervals for patients in three clinical  
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13 191 scenarios. [The hypothesis was that clinicians would be fully-compliant to NICE](#)  
14 [guidelines in their attitudes to intervals for VF testing. However, the results of the](#)  
15 [survey disprove this hypothesis.](#) We found a wide variation in designated test  
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19 194 intervals, with respect to NICE recommendations. This variation in attitudes is likely  
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21 195 to reflect differences in clinical practice, although this has yet to be established. A  
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23 196 recent retrospective study of 100 patients conducted at a single centre found that  
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25 197 89% of assigned monitoring intervals were in accordance with NICE guidelines.<sup>7</sup>  
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29 199 The variation in individual attitudes to the frequency of testing is reflected in  
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31 200 differing recommendations for the frequency of testing in glaucoma. For example,  
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33 201 NICE recommend VF testing at 6-12 month intervals for a patient at target IOP and a  
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35 202 stable VF.<sup>3</sup> The European Glaucoma Society (EGS) recommends three VF tests in the  
36  
37 203 first two years for a newly diagnosed patient with glaucoma, with vague guidance  
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39 204 thereafter.<sup>4</sup>  
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43 206 Given that more frequent testing is associated with a higher likelihood of identifying  
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45 207 progression, variations in practice with regard to the frequency of testing is likely to  
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47 208 imply inconsistencies in patient management and resource utilisation nationally. The  
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49 209 authors estimate the cost of a single VF in an NHS setting to be in excess of 50  
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51 210 pounds per test.<sup>8</sup> There are approximately 10,000 new cases of POAG per year. With  
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211 these estimated costs, 3 tests per year equates to a cost of 1.5 million pounds per  
212 year for this newly diagnosed patient cohort alone. Clearly, the outpatient workload  
213 for patients with glaucoma has substantial cost implications for the NHS.

214

215 In view of the implications of frequent testing, it is unsurprising that research has  
216 focused on frequency and intervals of VF tests.<sup>5 6 9-12</sup> One suggested approach is to  
217 vary the inter-test interval based on the outcome of previous tests.<sup>11 12</sup> Most of this  
218 research has recommended increasing the frequency of VF testing to ensure better  
219 sensitivity in diagnosing progression, without perhaps considering the cost/benefit  
220 ratio, or problems with false positive detection in the presence of increased testing.

221 One recent study proposed multiple tests at the start and end of a fixed  
222 'observation' period, for more reliable identification of progressing patients.<sup>6</sup>

223

224 It is interesting that 3 VF tests annually, the number which may be required to detect  
225 'rapidly' progressing patients and consistent with the number recommended by NICE  
226 for patients with suboptimal IOP and evidence of progression, was seen as  
227 impractical by many UK ophthalmologists with a specialist interest in glaucoma in  
228 terms of availability of hospital resources. It would seem that the potential utility of  
229 UK ophthalmology departments to perform the number of VFs to meet clinical  
230 guidelines needs further investigation. Whilst outsourcing visits to a community  
231 setting may lighten the hospital burden, this may have overall adverse cost  
232 implications.<sup>13</sup> Further discussion of issues about service delivery for glaucoma  
233 management is beyond the scope of this report. One possible approach to increasing  
234 diagnostic power to detect progression in the face of a limited number of VF tests is

235 to use alternative technology, in addition to VF testing for monitoring, such as optic  
236 nerve head imaging. Several methods have recently been suggested for integrating  
237 structural and functional tests for glaucoma progression<sup>14-16</sup> and the use of an  
238 additional diagnostic modality leads to greater accuracy for detecting progression  
239 than VF tests alone.<sup>15</sup> It remains to be seen if these research ideas can translate to  
240 clinical practice.

241 A limitation of this and all studies of this nature is the response rate. An assumption  
242 has been made that responses from the surveyed consultants is representative of  
243 subspecialist national practice in England and Wales. There are approximately 150  
244 Consultant Ophthalmologists in the England and Wales with a glaucoma  
245 subspecialist interest as estimated from a list obtained from the Royal College of  
246 Ophthalmologists. Our surveyed population would therefore represent nearly half of  
247 glaucoma specialists nationally. [Further, the assumption has been made that the  
248 method of survey delivery \(conference or postal\) has not influenced responses from  
249 participants and the responses have been combined for reporting.  
250 Responses to question 5 were classified into distinct categories for ease of  
251 interpretation, by only one of the investigators \(HB\). As the responses were generally  
252 non-ambiguous, it is unlikely that subjectivity contributed to misclassification of  
253 responses. The survey used was developed by consensus between scientists in vision  
254 research, psychology and ophthalmologists and is not a validated tool for assessing  
255 attitudes for VF testing.](#)

256 In conclusion, the variable attitudes of ophthalmologists with a glaucoma  
257 subspecialty to the frequency of VF testing in England and Wales highlights the need  
258 for further research in this area to, firstly establish current practice and, secondly



259 provide a firmer evidence base for designated VF test intervals. The longer term goal  
260 would be to ensure optimal resource utilisation and a consistent, high standard of  
261 practice nationally

262

### 263 **Competing Interests**

264 None of the authors have competing interests relevant to this work

265

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268 Services and Delivery Research programme (project number 10/2000/68). One of the  
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270 Moorfields Eye Hospital NHS Foundation Trust and UCL Institute of Ophthalmology.  
271 The views expressed are those of the author(s) and not necessarily those of the NHS,  
272 the NIHR or the Department of Health.

273

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278 NHS Trust & UCL Institute of Ophthalmology London), Claire Lemer ( North  
279 Middlesex University Trust), Carol Bronze (Patient, Moorfields Eye Hospital  
280 Foundation NHS Trust) and Rodolfo Hernandez (University of Aberdeen).

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### 282 **Data sharing statement**

283 Additional data, regarding the exact responses given by the specialists to the survey  
284 can be obtained by request from the corresponding author (DPC).

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46 **Article summary**

47  
48 **1) Article Focus**

49  
50 - There are approximately 1 million glaucoma-related outpatient visits in the NHS  
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52 annually  
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352 - Visual field (VF) testing is one of the most frequent investigations performed for  
353 monitoring patients with glaucoma and requires substantial and specialist resource  
354 utilisation

355 - A survey was conducted to establish attitudes to the frequency of VF testing in the  
356 UK with reference to guidelines from NICE and research recommendations

### 357 **2) Key Messages**

358 - Visual field monitoring intervals assigned by clinicians (for hypothetical patient  
359 scenarios) are very variable and often outside intervals recommended by NICE.

360 - Many specialists regard the research-recommended routine performance of 6  
361 visual field examinations in the first 2 years as impractical in the current health  
362 setting.

### 363 **3) Strengths and Limitations**

364 - This is the first survey to establish the views of glaucoma subspecialists to the VF  
365 monitoring intervals for patients with glaucoma.

366 - The surveyed population accounted for approximately half of specialists nationally  
367 and the assumption has been made that this sample is representative of UK practice.

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371

372 **Figure 1:** Responses from 70 Consultant Ophthalmologists with a declared  
373 subspecialist interest in glaucoma, giving minimum (lower error bars) and maximum  
374 (upper error bars) follow-up interval for a hypothetical patient with IOP at 'target'  
375 and **(a)** no evidence of visual field progression and no change in treatment; **(b)**

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6 376 evidence of visual field progression and no change in treatment; **(c)** uncertainty  
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8 377 about visual field progression and no change in treatment. Single bars represent  
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10 378 values for which only a single interval was given by respondents, without specifying  
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12 379 the minimum / maximum monitoring interval.  
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49 397 **Figure 2:** Summary of views of responders to the suggestion that 6 visual field tests  
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51 398 should be performed in the first 2 years for a newly-diagnosed patient with POAG  
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