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Citation: Bott, D., Huntjens, B. & Binns, A. M. (2018). Nutritional and smoking advice recalled by patients attending a UK age-related macular degeneration clinic. *Journal of Public Health*, 40(3), pp. 614-622. doi: 10.1093/pubmed/idx115

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Nutritional and smoking advice recalled by patients attending a UK age related macular degeneration clinic.

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Word count: 2,984

Keywords: Lifestyle advice, age-related macular degeneration, nutrition

Abstract (200 words):

Background: Age-related macular degeneration (AMD) is responsible for half of registered visual impairment in the UK. The Royal College of Ophthalmologists recommends providing guidance to people with AMD regarding smoking, diet, and nutritional supplements. The aim of this study was to investigate lifestyle advice recalled by patients with neovascular AMD (nAMD).

Methods: The study took place at a UK hospital outpatients' clinic. Eligible patients with unilateral nAMD were presented with a survey about lifestyle advice provision.

Results: Of 248 respondents, only 39.9% remembered receiving advice regarding diet at the hospital. Only 24.2% of respondents recalled receiving advice regarding nutritional supplements, and only 19.8% of respondents started taking daily supplements as a result of their AMD. The most prevalent reason for not taking supplements amongst those advised to do so was lack of understanding of how it would help their eyes. Nearly 13% of the sample reported currently smoking, 53.1% of which reported that they were advised to stop smoking when diagnosed with AMD.

Conclusion: The findings suggest that it would be beneficial to review the provision of lifestyle advice to patients attending AMD outpatients' clinics, and to consider whether advice is being provided in an optimal format for later recall.

INTRODUCTION

Age Related Macular Degeneration (AMD) is a degenerative condition of the central retina which is responsible for nearly 50% of certified sight impairment and severe sight impairment in the United Kingdom (UK).¹ Late AMD may manifest in two ways. Neovascular AMD (nAMD) is associated with a rapid visual loss associated with the growth of fragile new blood vessels beneath the retina, whilst geographic atrophy (GA) results in an insidious loss of central vision.² Owen et al (2012) estimated a prevalence of late AMD in the UK of 4.8% of people aged over 65 years and 12.2% of people aged over 80 years.³ The progressive loss of visual function attributable to AMD can be debilitating, resulting in reduced ability to carry out activities of daily living,⁴ problems with social engagement,⁵ and a markedly increased risk of suffering from depressive symptoms.⁶⁻⁸ In addition to the impact of late AMD on the individual, it also has substantial economic implications at a societal level. The costs incurred by late AMD not only encompass treatment for nAMD, but also indirect costs such as social care, hospital treatment for falls, management of depressive symptoms, and residential care.^{9,10}

The medical interventions which are currently approved by the National Institute for Health and Clinical Excellence (NICE) for the treatment of AMD are only effective in treating the neovascular form of the disease.^{11,12} However, epidemiological studies have identified numerous candidate modifiable risk factors for AMD.^{13,14} Smoking is considered to be the strongest modifiable risk factor for AMD,¹³ whereby smokers have been reported to have a four-fold increased risk of developing late AMD compared to non-smokers.¹⁵ The risk of AMD reduces back to that of a never-smoker within 10 years of quitting.¹⁶ The Royal College of Ophthalmologists Guidelines are therefore to advise all patients with AMD to stop smoking.¹⁷

Largely based on observational studies, certain diets have been proposed as being protective against AMD onset or progression, including a diet rich in omega-3 fatty acids, antioxidant vitamins, minerals, and carotenoids lutein and zeaxanthin.^{18,19} Although systematic reviews concluded that there is currently insufficient evidence to conclusively support a protective role of dietary antioxidant intake and omega-3 fatty acids,^{20,21} the guidance of the Royal College of Ophthalmologists is based on the premise that a diet rich in fruit and vegetables, oily fish and sources of lutein and zeaxanthin is unlikely to be harmful and may be beneficial.¹⁷

There is stronger evidence to support the recommendation of nutritional supplements. The Age Related Eye Disease Study (AREDS) reported a 25% reduction in 5-year risk of AMD progression in patients with intermediate or unilateral late AMD on taking a supplement with high doses of beta-carotene, vitamins C and E, and minerals zinc and copper.²² AREDS 2 found no additional benefit from adding lutein and zeaxanthin or omega-3 to the supplement in well-nourished populations.²³

However, by substituting beta-carotene for lutein and zeaxanthin, the formula becomes accessible to smokers.²⁴ The Royal College of Ophthalmologists guidelines recommend prescribing supplements based on the AREDS formulae in order to reduce risk of progression in those patients with intermediate AMD or unilateral late AMD, as long as there are no contra-indications.¹⁷

Despite the robust evidence to support the provision of lifestyle modification advice to people with AMD, a recent survey of optometrists and ophthalmologists suggested that clinicians are not universally providing the recommended education to patients.²⁵ The primary aim of this study was to investigate the lifestyle advice which patients attending a hospital outpatient clinic with a diagnosis of unilateral neovascular AMD (nAMD) recalled receiving from their hospital eyecare provider. A secondary aim was to investigate their self-reported compliance to advice given and, if appropriate, reasons for non-compliance.

METHODS

This cross-sectional survey-based study took place in the outpatients' Eye Department of a hospital in Yorkshire, UK between June and November 2015. Ethical approval was obtained from the local NHS Trust Clinical Governance Committee and City, University of London Research Ethics Committee. Each survey had an information sheet appended, and completion of the survey indicated provision of consent to participate. The study conformed to the tenets of the Declaration of Helsinki.

Survey

An anonymous, written, self-report survey included questions that reflect current evidence-based AMD professional guidelines.¹⁷ The survey, produced in large print, comprised a tick box format including 20 closed questions with spaces to elaborate on answers (see Appendix 1). Participants were encouraged to tick all responses that applied. In order to validate the response options of the survey, 10 participants completed a series of verbal open questions encompassing the same topics as the closed item questions in the survey. The aim of this process was to ensure that the answer options on the survey broadly matched the range of responses given.

Recruitment

Patients with diagnosed unilateral nAMD were eligible for inclusion. For pragmatic reasons, an inability to read or understand the survey was an exclusion criterion. Recruitment took place through the direct approach of potential respondents by a nurse, while the patients were in the clinic waiting room. The nurse handed the survey to suitable patients along with the Participant Information Sheet. Based on the medical records, the diagnosis for each eye was recorded by the

nurse on the survey. The survey was completed whilst the patient was waiting to see an ophthalmologist and returned into a dedicated box.

Statistical analysis

As this was an exploratory study, no formal sample size calculations were performed. The sample size was determined by the response rate within the timeframe of recruitment. Graphical representations show the proportion of participants responding positively to each option. Where participants were given the option of ticking numerous response items, the sum of all percentage values exceed 100%. Values in the text and tables are presented as the mean $\pm$ standard deviation (SD) (normally distributed data), and as median $\pm$ interquartile range (IQR) (non-normally distributed data). A sub-analysis was carried out to determine the effect of demographic characteristics on participant responses (χ^2 test for categorical variables; independent samples T-test or Mann-Whitney U test for continuous data). Statistical analyses were performed using SPSS for Windows (version 22.0, SPSS Inc., Chicago, USA). Data were tested for normality using the Shapiro Wilkes test. Statistical significance was accepted at the 95% confidence level ($p < 0.05$).

RESULTS

Surveys were submitted by 248 participants (see Table 1). The response items in the survey encompassed the range of responses given in the open answer interview. No adjustments were made to the survey as result of this process.

Dietary Recommendations

The majority of respondents ($n=149$; 60.1%) reported receiving no advice regarding diet from their hospital eye care practitioner (Figure 1A). The most prevalent advice was to eat more green leafy vegetables ($n=60$; 80.0% of the $n=75$ who recalled that advice was given). A large number of participants ($n=229$; 92.3%) did not remember receiving dietary advice from any source outside of the hospital (Figure 1B). Of the participants that did receive recommendations from an outside source, the advice was similar to that given by their hospital eyecare provider, with 9 (47.3% of people who received external advice) being advised to eat more green leafy vegetables and different coloured fruit/vegetables.

Only a minority ($n=28$; 11.3%) made a change to their diet as a result of their eyes (Figure 1C). The most common change was eating more green leafy and coloured vegetables ($n=15$, 53.6% of those who made a change). The reasons for not making any changes in diet are shown in Figure 1D. The most prevalent reason ($n=109$; 59.6% of those who made no change) was not being given any advice to do so, whilst 61 individuals (33.3%) felt that their diet was already sufficiently good. The median

age of those who had changed their diet (82 years IQR 11) was significantly higher than those who that had not (77 years IQR 14; Mann-Whitney; $p=0.04$). There was no significant difference in the proportion of people who made a change to their diet according to other demographic factors ($p>0.05$).

		All	Male	Female
General information (provided by all participants)	Number	248	90 (36%)	158 (64%)
	Mean Age $\pm$ SD (years)	80 $\pm$ 8.1	80.5 $\pm$ 8.1	80.0 $\pm$ 8.1
	Age range (years)	57-99	57-94	58-99
Living arrangements	Lives alone	113 (45.6%)	33 (36.7%)	80 (50.6%)
	Lives with relative/ partner/ friend/ carer	119 (48%)	55 (61.1%)	2 (2.2%)
	Lives in nursing home / assisted accommodation	9 (3%)	64 (40.5%)	7 (4.4%)
	Not answered	7 (2.8%)	0	7 (4.4%)
Time since diagnosis of AMD	Within the last year	65 (26.2%)	18 (20%)	47 (29.7%)
	1-2 years ago	53 (21.4%)	22 (24.4%)	31 (19.6%)
	2-5 years ago	68 (27.4%)	25 (27.8%)	43 (27.2%)
	>5 years ago	58 (23.4%)	25 (27.8%)	33 (20.9%)
	Not answered	4 (1.6%)	0	4 (2.5%)
Means of diagnosis	High street optometrist	146 (58.9%)	47 (52.2%)	99 (62.7%)
	Hospital eye care practitioner	65 (26.2%)	30 (33.3%)	35 (22.2%)
	GP	13 (5.2%)	8 (8.8%)	5 (3.2%)
	Diabetic Eye Screening Programme	4 (1.6%)	0	4 (2.5%)
	Not answered/couldn't remember/'self-diagnosed'	20 (8.1%)	5 (5.5%)	15 (9.5%)

Table 1: Demographic characteristics of participants answering Q1-5 of survey (see Appendix 1)

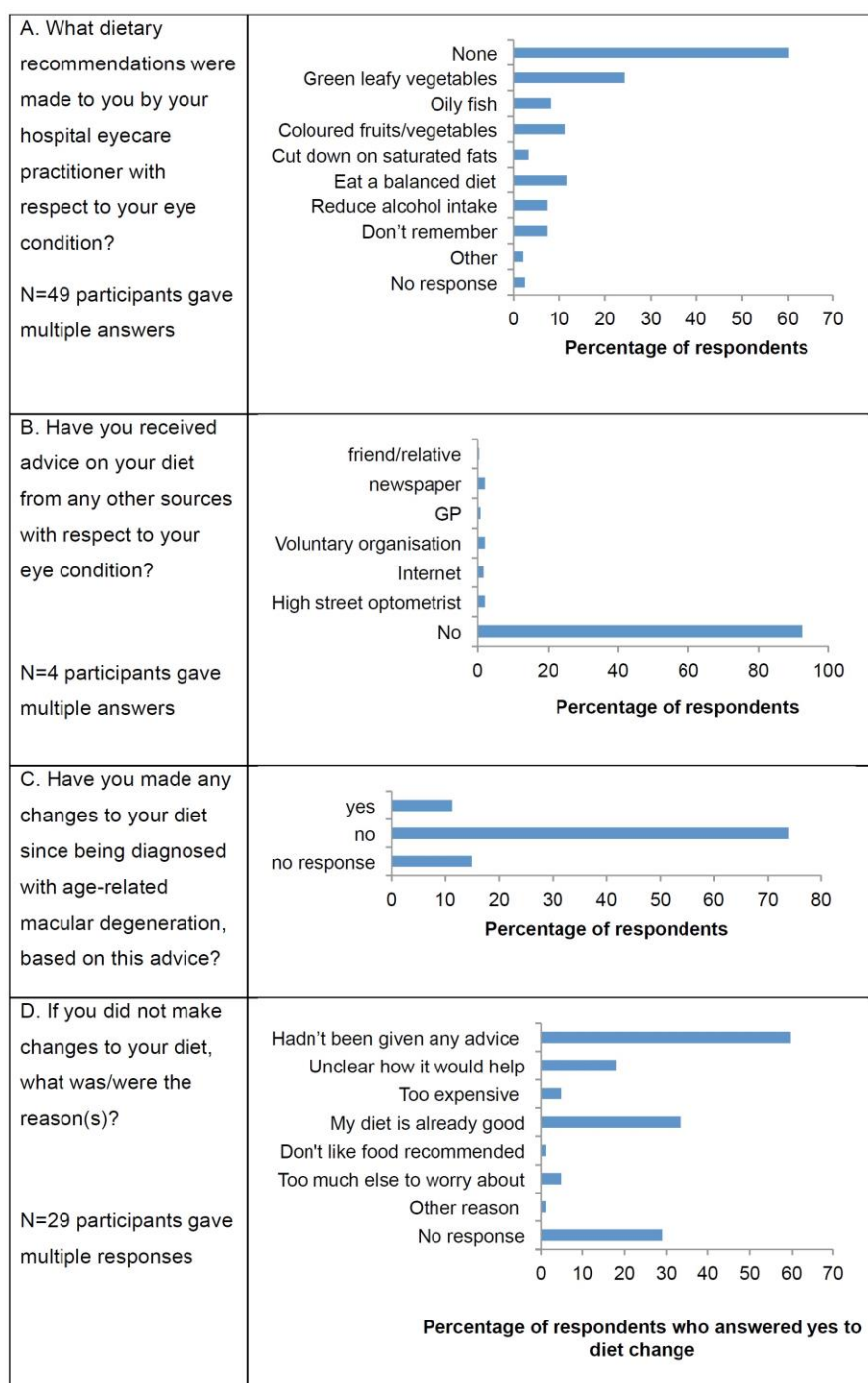


Figure 1A-D. Bar charts showing breakdown of responses to questions 6-9 regarding diet (survey Appendix 1). Percentages relate to the proportion of respondents giving a certain response. Where multiple responses were given by individuals, the sum of percentages exceeds 100%.

Nutritional Supplements

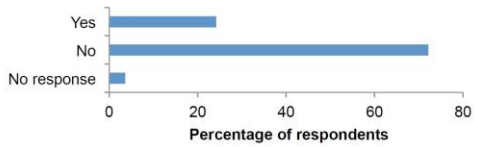
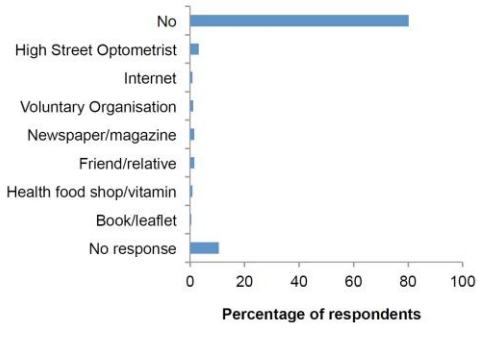
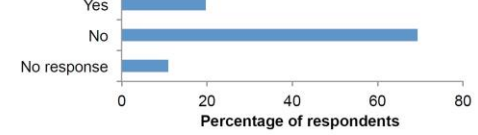
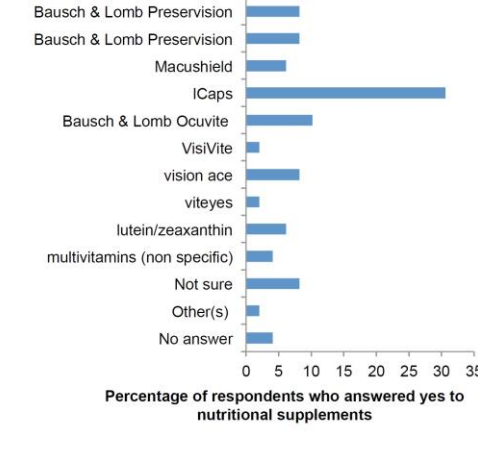
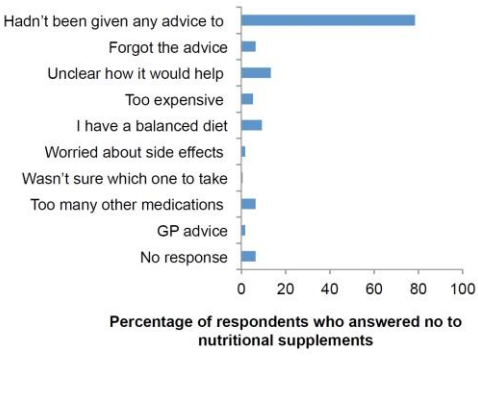
A. Did your eyecare practitioner recommend that you take a daily nutritional supplement? (e.g. vitamins, minerals etc)	 <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage of respondents</th> </tr> </thead> <tbody> <tr> <td>Yes</td> <td>25</td> </tr> <tr> <td>No</td> <td>70</td> </tr> <tr> <td>No response</td> <td>5</td> </tr> </tbody> </table>	Response	Percentage of respondents	Yes	25	No	70	No response	5																				
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Fig 2A-E. Responses to questions 10-14 regarding nutritional supplements (survey Appendix 1). Percentages relate to the proportion of respondents giving a certain response. Where multiple responses were given by individuals, the sum of percentages exceeds 100%.

Nutritional supplements were only recommended to 60 respondents (24.2%) by the hospital eye care practitioners (Figure 2A). Twenty-three (9.3%) were given supplement advice from a source other than their hospital eye care practitioner; the most common outside advice came from optometrists ($n=8$; 3.2% of total respondents) (Figure 2B). Only 49 (19.8%) respondents started taking daily nutritional supplements as a result of their AMD (Figure 2C). The most prevalent reason for not taking supplements amongst those who had been advised to do so was that they did not understand how it would help their eyes ($n=23$; 13.4% of non-supplement takers) (Figure 2D). ICaps were the most widely used supplement ($n=15$; 30.6% of people who reporting taking supplements; Figure 2E).

A significantly higher proportion of females than males reported taking supplements for their eyes (28.5% vs. 4.4%; χ^2 (1, $N=211$)=19.74, $p<0.001$). Whilst a higher proportion of women also reported receiving advice to take supplements from their hospital eyecare practitioner (28.5% vs. 16.7%; χ^2 (1, $N=239$)=4.20, $p=0.04$), there was no significant difference between genders regarding receiving advice from elsewhere (χ^2 (1, $N=222$)=0.77, $p=0.82$). The median age of people who reported taking supplements (77.5 years IQR 12.25) was significantly lower than those who did not (83 years IQR=10; Mann-Whitney, $p=0.002$). However, there was no significant effect of living arrangements (χ^2 (2, $N=216$)=2.51, $p=0.29$) or time since diagnosis (χ^2 (3, $N=218$)=1.87, $p=0.60$) on the proportion of people taking supplements.

Smoking advice

Nearly 13% of the total sample reported currently smoking ($n=32$), 41.9% used to smoke ($n=104$) and 43.5% had never smoked ($n=108$; $n=4$). Of the current smokers, the average length of time smoked ranged from 24-82 years (median 60, IQR 16.5) and average number of cigarettes smoked per day ranged from 4-40 (median 10, IQR 13.3). The number of pack years smoked ranged between 8-75 years (median 30, IQR 32.7). Seventeen (53.1% of participants who were current smokers) reported that they were advised to stop smoking when diagnosed with AMD. The most common reason for not stopping was they enjoyed it too much ($n=13$, 40.6%). The median age of current smokers was significantly lower (76 years IQR 8.5) than those who were previous smokers (83 years IQR 9 years) or never smokers (82 years IQR 13.75; Mann-Whitney test, $p=0.02$).

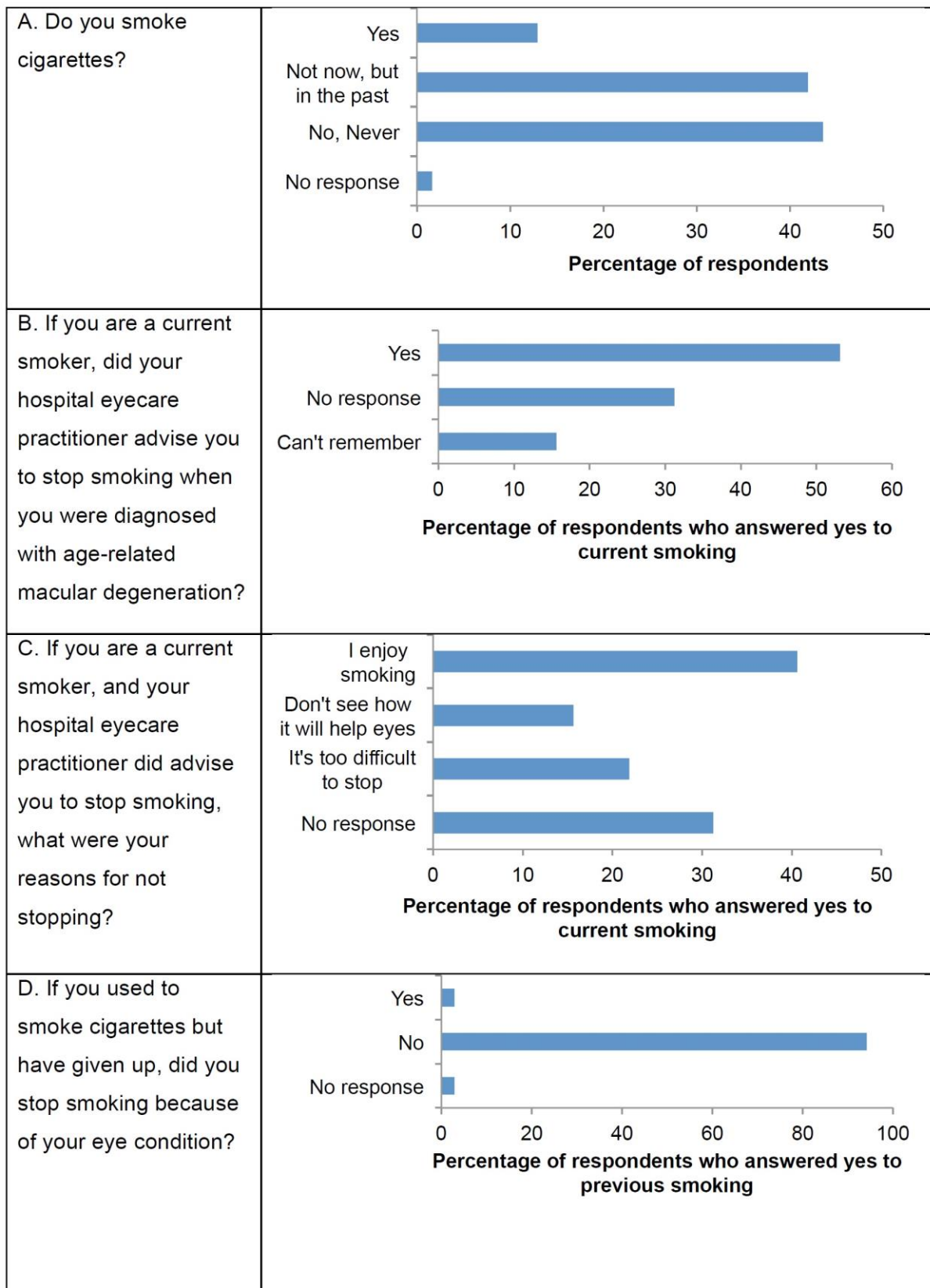


Fig 3A-D. Responses to questions 15-19 regarding smoking (survey Appendix 1). Percentages relate to the proportion of respondents giving a certain response. Where multiple responses were given by individuals, the sum of percentages exceeds 100%.

DISCUSSION

Main finding of this study

The findings of this study indicate that the majority of patients attending an outpatient clinic for the treatment of nAMD had no recollection of being offered dietary advice (60.1%) or nutritional supplements (75.8%), and only around half of current smokers recalled being advised to stop smoking. This is contrary to the guidance from the UK professional body for ophthalmologists.¹⁷

Given the robust findings of the AREDS(2) trials,^{22,23} that the appropriate nutritional supplements can delay disease progression in people with unilateral nAMD, it was surprising that nutritional supplements were only recommended to around a quarter of participants. The main reasons given by those who reported not taking nutritional supplements was that they were not advised to do so or that they did not understand how it would help their eyes. This highlights the need for enhanced education of the patients who would potentially benefit from supplementation. Unfortunately, whilst most participants were able to report the brand name of the supplements they took, they did not know which particular formula. This is relevant as many brands (e.g. Macushield and iCAPS) now produce a variety of formulae, only some of which are AREDS compliant. Further study is required to investigate whether patients are taking the most appropriate supplement.

A greater proportion of females than males reported receiving advice to take supplements. The differential was even greater with respect to taking nutritional supplements (4% males vs. 29% females), suggesting a higher level of adherence to advice of women than men. Females did not show higher rates of compliance in terms of diet or smoking, indicating that the gender effect may be variable for different aspects of lifestyle advice. The effect of age was also variable, with older age being associated with greater adherence to dietary advice, but poorer adherence to supplement intake advice. Such demographic effects should be considered when targeting future educational materials to address lifestyle advice in people with AMD.

Around 13% of the sample reported currently smoking, despite over half of them receiving advice to the contrary. The finding that smokers were significantly younger than non-smokers may reflect either the earlier age of onset of nAMD in smokers,²⁶ or the reduced longevity.²⁷ Given the robust evidence regarding the elevated AMD risk associated with cigarette smoking,²⁶ the proportion of smokers given advice on cessation by their hospital eyecare provider would be expected to be substantially higher than 50%.

What is already known on this topic

Lawrenson and Evans conducted a survey of 1468 UK optometrists (96.3%) and ophthalmologists (3.7%) through the Royal College of Ophthalmologists and the College of Optometrists.²⁵ They reported that 68% of practitioners surveyed claimed to provide advice on diet to people with AMD whilst 93% of respondents recommended nutritional supplements to people with unilateral nAMD.²⁵ However, it is notable that the AREDS formula was recommended by only 13.5% of respondents in the scenario of a patient with unilateral AMD.²⁵ Thus, whilst a greater proportion of clinicians purport to provide lifestyle advice to patients than would be expected from the results of our patient survey, there is evidence that a high proportion of clinicians may be unaware of best evidence based practice guidelines.

A study of 158 people with AMD conducted through the Macular Society helpline in the UK reported that 30% had discussed nutritional supplements with their Ophthalmologist, and 15% with their Optometrist.²⁸ This is broadly in line with the ~25% in this study. However, 79% of males and females interviewed in the previous study reported taking supplements (compared to 29% of females and 4% of males in the current study). This difference is likely to be attributable to the different sample – individuals associated with the Macular Society may be more motivated to make lifestyle changes than a cross-section of individuals attending an outpatients' clinic.

In accordance with this, literature suggests that, given appropriate advice provision, it is possible to achieve much higher rates of patient uptake of nutritional supplements than the 19.8% reported in this study. A survey in the United States of 332 patients with AMD reported that, of those eligible for AREDS type supplements, 61% were recorded as compliant.²⁹ Similarly, a survey of individuals with AMD being treated at a vitreoretinal service in California reported that 98% of 92 patients remembered receiving advice about AREDS supplements; compliance was 88%.³⁰ A questionnaire study of 163 outpatients diagnosed with AMD at Keio University Hospital, Japan, found that 35% used an AREDS type supplement under their Ophthalmologist's instruction.³¹ Similarly to our study (58%), this equated to 62% of all of the participants who had received advice by their ophthalmologist to take the supplements. These findings reinforce the importance of advice provided by a trusted healthcare provider.

The results of our survey tally with previous findings whereby only a third of clinician (mainly optometrist) respondents actively asked about a patient's smoking history or engaged in providing advice on smoking cessation.²⁵ In a previous study of 485 ophthalmologists, 35% claimed to regularly advise patients to quit smoking.³² The public is largely unaware of the association between smoking and the risk of AMD.³³ Until this issue is addressed on a wider basis, the onus is on healthcare

professionals to address this deficit in public awareness. However, a study reporting an adherence rate above 80% to advice about nutritional factors in people with AMD found that none of the individuals who smoked followed advice to quit.³⁰ This reported finding suggests that the message may be harder to convey than advice about dietary changes.

What this study adds

This is the first study to analyse self-reported data on lifestyle advice from patients with AMD in the UK tertiary care system. It provides important complementary information to previous data obtained from clinicians because, uniquely, this type of survey provides evidence about the advice *retained* by patients in a high-risk group for AMD progression, rather than just about the *provision* of advice. Much of the prior knowledge base in this field was generated by the key study by Lawrenson and Evans.²⁵ Importantly, the data from this previous study of clinicians suggest a more comprehensive pattern of information provision to patients than the patient-reported results presented here. It is likely that this discrepancy reflects a mismatch between the provision of advice and the ability of patients to recall the advice at a later date. This is important as it indicates a need for services to focus not only ensuring that appropriate advice is given to patients, but also on how the educational material is provided to maximise patient recall and compliance. The discrepancy may also reflect the fact that clinicians responding to a survey provided through their professional body may over-represent those individuals inclined to be responsive to continuing education initiatives.

Limitations of this study

Overall, this study indicated that a lower proportion of patients is aware of receiving lifestyle advice than the proportion of practitioners who claim to be providing it.^{25,32} One limitation of this study was that, whilst participants were asked about nutritional supplement intake, insufficient details were obtained to determine whether the majority were taking AREDS or AREDS2 compliant formulae. Another limitation of this study was that the tick box format for the survey might have encouraged patients to present a more positive representation of their changes in lifestyle behaviour, in order to please their clinician, although the chance of this was minimised by the anonymity of the patient surveys. This effect would also be more likely to present an over-optimistic view of the lifestyle habits of the participants. The findings of this study therefore suggest that it would be beneficial to review the provision of lifestyle advice to patients attending an AMD outpatients' clinic, and to consider whether advice is being provided in an optimal format.

Financial Disclosures and Acknowledgements

None

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APPENDIX 1

No.	Question	Response Options
1	What is your age in years?	Specify years
2	Are you...	Male/Female
3	Which of the following best describes your living arrangements?	I live alone; I live with relative/ partner/ friend/ carer; I live in a nursing home Other (please specify)
4	How long ago were you diagnosed with age-related macular degeneration?	Within the last year; 1-2 years ago; 2-5 years ago; >5 years ago
5.	Who first detected your age-related macular degeneration?	High Street Optometrist; Hospital Eye Care Practitioner; GP; Don't remember; Other (please specify)
6.	What dietary recommendations were made to you by your hospital eyecare practitioner with respect to your eye condition? (tick all that apply)	None; Eat plenty of green leafy vegetables; Eat more oily fish; Eat lots of different coloured fruits and vegetables; Cut down on saturated fats; Eat a balanced diet; Reduce alcohol intake; Don't remember; Other (please specify)
7.	Have you received advice on your diet from any sources outside of the hospital with respect to your eye condition? (tick all that apply; summarise advice given)	High street Optometrist; Internet; Macular Society / RNIB / Other voluntary organisation; GP
8.	Have you made any changes to your diet since being diagnosed with age-related macular degeneration, based on this advice?	No (go to Qu 9); Yes (please describe the changes you have made)
9.	If you did not make changes to your diet, what was/were the reason(s)? (tick all that apply)	I hadn't been given any advice to change my diet; I didn't understand how it would help my eyes; Too expensive; My diet is already good; I/my family/partner don't like the foods recommended; Too much else to worry about / too much hassle; Other reason (please specify)
10	Did your hospital eyecare practitioner recommend that you take a daily nutritional supplement? (e.g. vitamins, minerals etc)	Yes/No
11.	Have you received advice to take daily nutritional supplements from any other sources with respect to your eye condition? (tick all that apply; summarise advice given)	No; High street Optometrist; Internet; Macular Society / RNIB / Other voluntary organisation; GP; Newspaper / magazine; Friend / relative; Other (please specify)
12.	Have you started taking daily nutritional supplements as a result of your eye condition?	Yes (go to Qu 13); No (go to Qu 14)
13.	If you have started taking daily nutritional supplements as a result of your eye condition, which are you taking? (tick all that apply)	Bausch & Lomb Preservision; Bausch & Lomb Preservision AREDS2; Macushield; ICaps; Bausch & Lomb Ocuvite; VisiVite; Not sure; Other(s) (please specify)
14.	If you did not start taking daily nutritional supplements, what was/were the reason(s)? (all that apply)	I hadn't been given any advice to do so; I forgot the advice; I didn't understand how it would help my eyes; Too expensive; I have a balanced diet; I am worried about the potential side effects; I wasn't sure which one to take; I have too many other medications to take; Other (please specify)
15	Do you smoke cigarettes?	Yes (go to Qu 16); Not now, but I did in the past (go to Qu 19); No, never (go to Qu 20)
16	If you are a current smoker, please could you answer the following: How many cigarettes do you smoke, on average, per day? For how many years have you smoked?	Specify number of cigarettes; Specify number of years smoked
17	If you are a current smoker, did your hospital eyecare	Yes/No/can't remember

	practitioner advise you to stop smoking when you were diagnosed with age-related macular degeneration?	
18	If you are a current smoker, and your hospital eyecare practitioner did advise you to stop smoking, what were your reasons for not stopping?	I enjoy smoking; I don't see how it will help my eyes; It's too difficult to stop; Other (please specify)
19	If you used to smoke cigarettes but have given up, please could you answer the following: How many cigarettes did you used to smoke, on average, per day? For how many years did you smoke? Did you stop smoking because of your eye condition?	Specify number of cigarettes; Specify number of years smoked; Yes/no
20.	Other than verbal advice and information, were you provided with any of the following by your hospital eyecare practitioner? (tick all that apply)	An information sheet / leaflet about lifestyle changes; Information about support groups, such as the Macular Society; An information sheet / leaflet about your eye condition

Appendix 1: Survey items