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Geographic Atrophy Management Consensus (GA-MAC): a Delphi panel study on identification, diagnosis and treatment

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ABSTRACT

Background/aims With a paradigm shift in geographic atrophy (GA) treatments now available, establishing consensus on the identification and diagnosis of the disease along with considerations for management of patients with GA will assist eye care professionals (ECP) in their day-to-day practices, leading to improved patient outcomes.

Methods A modified Delphi panel process (Geographic Atrophy Management Consensus) consisting of three total surveys and one virtual live meeting held between survey 2 and survey 3. Data were collected from July to October 2022. Participants included expert members of the eye care community that have demonstrated outstanding leadership among peers: a steering committee with three ECPs and a 15-member panel divided between five optometrists, five comprehensive ophthalmologists and five retina specialists. Consensus on statements related to the management of patients with GA was calculated using the RAND/UCLA Appropriateness Method.

Results At the conclusion of the third survey, consensus was reached on 91% of the 77 statements. Critical consensus topics include: (1) optical coherence tomography as the favoured method to diagnose and monitor GA, (2) preferred practice patterns regarding referral of patients to retina specialists and (3) treatment criteria given the advent of emerging therapeutics for GA.

Conclusions Generating awareness of early signs of disease development, progression and identifying the best tools to evaluate GA establishes ideal management and referral strategies. Given the paradigm shift in GA management driven by approved therapies, coupled with the fact that the disease is progressive resulting in devastating vision loss, these strategies are critical to ensure best overall outcomes.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Geographic atrophy (GA) is a widely studied area of ophthalmology; however, to our knowledge, there are currently no consensus guidelines on the identification, diagnosis or management of patients with the disease.

WHAT THIS STUDY ADDS

⇒ In this Delphi panel study including retina specialists, ophthalmologists not specialised in retina and optometrists, a consensus was reached in 91% of the 77 statements regarding risk factors associated with progression, early diagnosis, follow-up, impact on quality of life, referral recommendations and treatment recommendations of patients with GA.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Treatments for wet age-related macular degeneration have evolved quickly in the past years, yet therapeutic options for GA have developed at a slower pace. The points discussed are relevant for the care of patients with GA and will aid in consensus and guidance on topics where there are currently no definitive guidelines proposed by professional associations.

INTRODUCTION

Geographic atrophy (GA) secondary to dry age-related macular degeneration (dAMD) is a progressive retinal disorder that can cause irreversible central vision loss and permanent legal blindness. One hallmark of dAMD is characterised by drusenoid formation, consisting of proteinaceous and lipid agglomerates from retinal waste products, within the retinal pigment epithelium (RPE).[1] Intermediate dAMD is defined as extensive medium drusen (63–124 µm in diameter) or >1 large drusen (>125 µm in diameter) in at least one eye. The progression rate from intermediate to advanced dAMD is 18% in 5 years, varying from 6.3% for patients with unilateral large drusen to 26% for patients with multiple bilateral large drusen.[2] Advanced AMD is defined as

either neovascular AMD (nAMD) or GA, which can occur simultaneously in the same eye.[2–4]

GA affects over 5 million people worldwide, yet the number of patients with GA continues to increase due to longer lifespans and increased prevalence of GA with ageing. GA is one of the leading causes of vision impairment with an estimated 1 in 29 people over the age of 75 in the USA currently living with GA.[4 5]

Recently, the eye care community has made strides in closing knowledge gaps surrounding the diagnosis and treatment of AMD through Delphi studies.[6–10] However, there are currently no peer-reviewed publications specific to a Delphi panel centred on diagnosis, management and treatment of GA. With a paradigm shift in GA treatment options now available, this study aims to improve current understanding of how this condition is viewed by achieving consensus surrounding diagnostic criteria, improve patient referral patterns and optimise management and treatment strategies for patients with GA.

METHODS

Study design and development

A modified Delphi methodology[11] was used to reach consensus concerning various GA topics through three electronic surveys and one live virtual meeting. The technique was initially developed for technological forecasting but has been commonly adopted in medical research.[12] The Delphi process is a facilitation technique that transforms individual opinions into group consensus through a series of questionnaires. The anonymous nature of the Delphi methodology prevents any single panellist from influencing the opinion of the group.[11]

Participants

A steering committee was established with three expert eye care professionals (ECP): one optometrist, one comprehensive ophthalmologist and one retina specialist. Their roles included strategic guidance, panellist selection, literature review, survey development, response analysis and live meeting moderation. The panel included 15 ECPs from the USA, all with extraordinary publication records in their fields and active leadership in vision care: five optometrists, five comprehensive ophthalmologists who play significant roles in referrals to subspecialties and five retina subspecialists. A third-party medical communications agency (i2Vision, San Diego, California) provided logistical support in the execution of the study.

Surveys and live discussion

Survey 1 (online supplemental eTable 1) consisted of 67 scaled, open-ended and closed-ended statements and questions (yes/no, numeric and true/false) divided into five sections: participant profile, diagnosis and progression, impact on quality of life (QOL), patient referral and treatment. Each panellist also received a literature package curated by the steering committee. Survey 1 results were used to understand initial areas of consensus or disagreement among panellists and to guide any necessary question reformulation for survey 2.

Survey 2 included 79 statements divided into six sections: risk factors, diagnosis, follow-up, impact on QOL, patient referral and treatment. This survey used a 9-point Likert scale for consistent statistical consensus analysis. Along with survey 2, panellists received the pooled results from survey 1.

Following survey 2, a virtual meeting was scheduled to foster discussion among panellists. The meeting was held via Zoom (Zoom Video Communications, San Jose, California) and recorded for review and dissemination. After the meeting, panellists received the pooled results from survey 2, an expanded literature package, the meeting recording and survey 3, which consisted of 77 statements following the same scaling and sections of survey 2.

Analysis

After initial guidance from survey 1, all questions on surveys 2 and 3 were standardised and subjected to identical analysis. Panellists were asked to rate their agreement with statements on a scale from 1 (strongly disagree) to 9 (strongly agree). A median of 7–9 indicated the panel considered the statement appropriate, 1–3 inappropriate and 4–6 uncertain. Statistics were calculated as follows: First, the median value (50th percentile) and interpercentile range (IPR) were determined. The IPR measures the dispersion of distribution determined by subtracting the lower IPR (30th percentile) from the upper IPR (70th percentile). Second, the asymmetry index was obtained by calculating the distance between the central point of the IPR and the central point of the 1–9 scale (ie, 5). Third, the value of the IPR adjusted for symmetry (IPRAS) was calculated, which assesses the degree of asymmetry across the scale. Finally, the disagreement index (DI) was calculated by dividing the IPR by the IPRAS. The DI indicates the dispersion of ratings. The lower the DI, the lower the level of disagreement (ie, greater consensus).[12] Consensus was defined as a median of 1–3 or 7–9 and a DI<1.

RESULTS

Panellists' overall knowledge of GA varied from 'low' to 'very high', showcasing the need for a study of this nature. Table 1 reports complete panellist demographics.

All surveys had a 100% response rate, and 13 (86.7%) panellists attended the virtual meeting. All reported results are pooled from survey 3. Since scaled questions solicit a range of answers, results are presented with corresponding analysis as follows: (median (range); DI). Full results from survey 3 are reported in online supplemental eTable 2.

Risk factors

The panellists achieved consensus that smoking (9 (5–9); 0.132), gender (7 (1–9); 0.652), family history (8 (5–9); 0.132) and specific genes (9 (5–9); 0.132) are all risk factors for progression to GA. Consensus was not

Table 1 Characteristics of the 15 panellists for the GA-MAC Delphi study

Type of practice (%)	
Optometrist	5 (33.3)
Ophthalmologist (not retina specialist)	5 (33.3)
Retina specialist	5 (33.3)
Main patient population demographic (%)	
Rural	0
Urban	7 (46.7)
Mixed	8 (53.3)
Holds joint position within academia (%)	
Yes	11 (73.3)
No	4 (26.7)
Years of practice (%)	
<6	0
6–10	2 (13.3)
11–15	4 (26.7)
16–20	0
>20	9 (60.0)
Current knowledge of geographic atrophy (%)	
Very low	0
Low	2 (13.3)
Average	5 (33.3)
High	5 (33.3)
Very high	3 (20.0)
Current patients with GA (%)	
0–20	13 (86.7)
21–40	2 (13.3)
41–60	0
61–80	0
81–100	0
Practice has in-house retina specialist* (%)	
Yes	6 (60.0)
No	4 (40.0)
Practice has in-house retinal fundus photography capabilities (%)	
Yes	15 (100)
No	0
Practice has in-house spectral domain optical coherence tomography capabilities (%)	
Yes	15 (100)
No	0
Practice has in-house fundus autofluorescence imaging capabilities (%)	
Yes	12 (80.0)
No	3 (20.0)
Has previously referred a patient for any GA trial (%)	
Yes	5 (33.3)
No	10 (66.7)

*Excludes those who designated themselves as retina specialists for type of practice.
GA, geographic atrophy; GA-MAC, Geographic Atrophy Management Consensus.

achieved on whether or not eye colour (6 (2–9); 1.360), body composition (ie, body mass index (BMI)) (6 (2–9); 0.450) or myopia (5 (1–8); 0.720) was a risk factor for progression.

Impact on QOL

Panellists overwhelmingly agreed that GA has a detrimental impact on a person's QOL (9 (7–9); 0.103). Moreover, panellists achieved consensus that GA brings a burden to family members and caregivers (9 (7–9); 0.103) and that there is a high societal cost associated with GA (9 (7–9); 0.103). To evaluate the treatment burden from the perspective of a patient with GA, panellists agreed that QOL questionnaires are useful (8 (5–9); 0.269). Panellists also indicated that best corrected visual acuity (BCVA) does not reflect the impact of GA on a patient's QOL (9 (3–9); 0.132), but low luminance tests may be more useful to evaluate functional vision in patients with GA (7 (5–9); 0.164).

Diagnosis

Consensus was reached on 100% of questions pertaining to GA diagnosis. Panellists concurred without any statistical disagreement that (1) there are signs of impending GA that precede actual appearances of GA (9 (6–9); 0.000), (2) GA progression can cause decreases in BCVA (9 (6–9); 0.000) and (3) GA progression can cause a central scotoma (9 (6–9); 0.000). Panellists reached consensus with only minor statistical disagreement in stating that GA progression can cause a metamorphopsia (9 (6–9); 0.103) and that there are clear physiological signs that precede conclusive GA diagnosis (8 (5–9); 0.164). Panellists unanimously disagreed that diagnosis of GA requires patients to experience visual symptoms (1 (1–8); 0.132), indicating that patients do not need to experience visual complications to be diagnosed with GA.

Concerning clinical methods of identification and diagnosis, panellists agreed that GA lesions can be identified on a dilated fundoscopic examination (8 (2–9); 0.257) and diagnoses can be confirmed through both fundus autofluorescence (FAF) (9 (7–9); 0.103) and optical coherence tomography (OCT) (9 (7–9); 0.000). In the case of FAF, members concur that GA is observed as an atrophic area with loss of RPE denoted by hypoautofluorescence areas within the macula (9 (5–9); 0.103), and adjacent areas of increased autofluorescence may precede the enlargement of pre-existing atrophy (9 (7–9); 0.132). Regarding how GA lesions appear on OCT, panellists agreed that a GA lesion is observed as complete atrophy of RPE and outer retinal layers (9 (6–9); 0.132) and that incomplete RPE and outer retinal atrophy is an OCT finding preceding GA development (9 (7–9); 0.132).

Patient referral

Consensus was achieved that (1) patients with intermediate AMD (drusen >125 µm) (7 (2–9); 0.299), (2) patients with GA but without vision loss (8 (5–9); 0.164),

(3) patients with intermediate AMD and pigmentary changes in the retina (8 (2–9); 0.164) and (4) patients with vision loss and early AMD (8 (7–9); 0.000) could be referred to retina specialists. Panellists discussed comanagement as an ideal strategy for monitoring patients and believe the referring optometrist or ophthalmologist should continue following the patient after referring them to a retina specialist (8 (2–9); 0.128).

Patient follow-up

Panellists agreed that ideal GA progression monitoring should be conducted either with FAF (9 (7–9); 0.103) and/or OCT (9 (7–9); 0.103) but not with dilated fundoscopic examination alone (3 (1–8); 0.565). Elaborating on testing during patient visits, panellists agreed that Amsler grid is of limited use for monitoring patients with GA (8 (2–9); 0.257). Panellists were asked several questions pertaining to GA progression. They acknowledged that GA lesions can have varied growth rates (9 (7–9); 0.103) and that lesions can progress without symptomology (9 (7–9); 0.103). Concerning types and location of lesions and their effect on progression, consensus was established that, on average, eyes with multifocal GA lesions progress faster than those with unifocal lesions (8 (5–9); 0.292) and, on average, eyes with extrafoveal GA lesions progress faster than those with foveal lesions (8 (3–9); 0.448).

Questions concerning potential consequences of GA were also posed. It was recognised that patients with GA can develop macular neovascularisation (MNV) (9 (5–9); 0.132) and that the incidence of MNV development increases in patients with GA (8 (1–9); 0.164). Conversely, consensus was established that patients with nAMD can also develop GA or macular atrophy (9 (8–9); 0.132), indicating that these diseases can be concurrent, regardless of which occurs first.

One of the more important items of consensus was the frequency of office visits. Panellists determined that patients with GA should ideally be seen every 6 months (8 (6–9); 0.000). During these visits, either FAF (8 (6–9); 0.107) and/or OCT (9 (7–9); 0.132) could be used to monitor GA progression.

Genetic testing in the context of GA was discussed. Panellists disagreed that genetic testing should be routine for the management of patients with GA (2 (1–5); 0.652), indicating they do *not* believe genetic testing is necessary for GA management. However, consensus was *not* achieved that genetic testing should be offered to patients with GA (5 (1–7); 0.519), illustrating contention regarding genetic testing as it relates to GA.

Treatment

At the time of this Delphi panel, there were no Food and Drug Administration (FDA)-approved therapies specifically for GA. However, panellists were aware that there are emerging therapies (9 (7–9); 0.103). Panellists disagreed that these emerging therapies (1) can improve BCVA (2 (1–9); 0.871), (2) can stop GA progression (2 (1–5); 0.132) and that (3) patients without symptoms do not need invasive treatments (2 (1–5); 0.132), indicating panellists acknowledge these treatments do not improve vision or completely stop lesion growth and that patients at any stage could receive intravitreal injections. Panellists reached consensus that the complement pathway currently appears to be the best therapeutic target for GA (8 (5–9); 0.164) and that these emerging therapies can *slow* GA progression (9 (7–9); 0.132). Panellists would recommend intravitreal injection therapies for patients with GA whether or not they have symptoms if the treatment showed the potential to slow GA growth (9 (7–9); 0.103). While panellists agreed that a therapeutic regimen of monthly intravitreal injections is suitable for qualified patients (8 (5–9); 0.164), they acknowledged that injection frequency is the biggest drawback for emerging GA therapies (8 (5–9); 0.257).

DISCUSSION

The management of GA is expected to change considerably since there are now 2 FDA-approved therapies.[13] This paradigm shift in GA treatment demonstrates the importance of understanding how ECPs view this condition and why establishing consensus around disease diagnosis, patient management and treatment strategies is paramount. The management of patients with AMD, including GA, is not exclusive to retina specialists, as patients are often diagnosed and followed by an optometrist or general ophthalmologist. Therefore, every ECP must be able to understand and identify risk factors, signs and symptoms associated with GA and identify which factors and presenting features of GA confer at higher risks of progression.

Since GA is a multifactorial disease,[2] studies that analyse associated factors are observational, therefore causal associations should be interpreted with caution given multiple confounding variables. While there are known risk factors associated with development of advanced AMD, their full contribution varies on patient-by-patient bases.[2] Although females have a higher risk of dAMD and nAMD, there is no evidence of a gender difference in GA.[14 15] Panellists did not reach consensus on myopia, eye colour and BMI as factors associated with GA, which may be attributed to conflicting literature on associations with GA specifically, compared with AMD. While older patients with myopia have a higher risk of dAMD and nAMD,[16] there is no direct link with GA. Although Northern European ancestry is a known risk factor for AMD,[2] there are no specific data relating GA to eye colour. Finally, while a higher BMI has been associated with nAMD in the Age-Related Eye Disease Studies population,[15] the Beaver Dam study only showed an association of higher BMI with early AMD but not nAMD.[17]

Consensus was reached on all statements regarding GA diagnosis. Although GA can present with decreases in BCVA, metamorphopsia or a central scotoma, visual symptoms are not required to establish the diagnosis, given the fact that patients may be asymptomatic. Although

signs of GA may be identified on a fundoscopic examination, FAF or OCT are critical diagnostic tools used to confirm GA and should be performed during initial visits and follow-up examinations. Panellists favoured the use of OCT over FAF, given its widespread presence in clinic. Distinct features on OCT are associated with a risk of GA development or progression, including ellipsoid zone disruption, RPE perturbation with associated hypertransmission, hyper-reflective foci and large subretinal drusenoid deposits.[18] Of note, distinct FAF patterns (eg, diffuse trickling) may serve as prognostic biomarkers that may precede the enlargement of pre-existing atrophy.[19]

Concerning GA progression and how it may effect patient management, multifocal and extrafoveal GA lesions progress faster on average than unifocal and foveal lesions, respectively.[1] Aligned with the literature, there was consensus that nAMD and GA can occur in the same eye, and the incidence of nAMD actually increases for patients with GA.[4] The only statement that did not reach consensus concerned genetic testing. A genome-wide association study (GWAS) of AMD identified 52 independently associated variants and developed a risk model that could identify a 44-fold increased risk of developing advanced AMD.[20] Despite this evidence, the prognostic relevance of this information has not been thoroughly validated.

It is widely accepted that GA negatively impacts patients and caregivers and has high societal costs. Although GA effects on QOL are comparable to end-stage prostatic cancer or a catastrophic stroke,[21] there is limited qualitative, patient-driven research on the impact of GA-related vision loss on QOL.[22] GA progression is associated with reduced independence, mental well-being and ability to carry out daily tasks (eg, driving). Additionally, GA increases the risk of depression and the predisposition to falls and injuries.[23] Because lesions might not encroach on the fovea and affect central vision until late stages, BCVA is a poor reflection of the impact of GA on QOL.[24] Therefore, panellists agreed that BCVA alone should not be used to assess visual function in patients with GA, and other tests (eg, low luminance visual acuity and questionnaires) may be more helpful in evaluating patients with GA. While panellists agreed that visual aids could help patients with GA read more effectively, it is equally important to set realistic expectations for patients with severe visual loss.[2 25]

Given the absence of guidelines on when, or if, patients with dAMD should be referred to retina specialists, the discussion surrounding management of patient with GA is important for all ECPs. While disease detection at the earliest stages is ideal, panellists agreed that patients with dAMD should be referred to retina specialists when intermediate drusen, with or without pigmentary changes, is detected. Although the majority of ECPs might be accustomed to managing patients with dAMD (including GA) without involving retina specialists, emerging GA therapeutic options may change this approach. Proper diagnosis and management of patients with GA will be vital to initiate prompt treatment options when available and help alleviate burdens on retina clinics from increased volumes of examinations and procedures.

To assess awareness about GA-specific therapeutic avenues, the survey asked about emerging treatments. Supported by several GWAS that uncovered complement factor gene variants associated with increased AMD risk,[20 26–29] panellists agreed that the complement pathway is the most favourable current avenue for targeting GA. The current most advanced drug candidates are pegcetacoplan (C3) and avacincaptad pegol (C5), the former of which recently received FDA approval and the latter having completed pivotal phase III trials. Based on clinical trial data, there was consensus that these therapies could not improve BCVA due to existing tissue atrophy nor stop GA progression but instead slowed GA progression.[30 31]

The panellists would consider intravitreal injections for patients with GA, even if the treatments only slow GA progression. However, they acknowledge frequent injection burden as a significant drawback for receiving treatment. Patients without visual symptoms might be particularly resistant to treatment because they are not expected to experience visual improvement. Therefore, education of ECPs regarding the importance of slowing disease progression through treatment is paramount.

This Delphi study on GA management achieved consensus on most statements presented to panellists. Besides generating awareness of early signs of disease development and progression and determining the best diagnostic modalities to evaluate patients with GA, establishing ideal referral strategies ensures patients receive the maximum benefit from GA treatments. If additional GA treatments emerge, supplementary Delphi panels may be beneficial to further develop ideal patient management and treatment strategies.

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REFERENCES

1 Fleckenstein M, Mitchell P, Freund KB, *et al*. The progression of geographic atrophy secondary to age-related macular degeneration. *Ophthalmology* 2018;125:369–90.
2 Flaxel CJ, Adelman RA, Bailey ST, *et al*. Age-related macular degeneration preferred practice pattern®. *Ophthalmology* 2020;127:1–65.
3 Chew E, Davis M, Seddon J, *et al*. The effect of antioxidant and zinc supplements on change in Drusen size/area in the age-related eye disease study (AREDS). *Invest Ophthalmol Vis Sci* 2002;43:1903.
4 Sunness JS. The natural history of geographic atrophy, the advanced atrophic form of age-related macular degeneration. *Mol Vis* 1999;5:25.
5 Friedman DS, O'Colmain BJ, Muñoz B, *et al*. Prevalence of age-related macular degeneration in the United States [published correction appears in Arch Ophthalmol. 2011 Sep;129(9):1188]. *Arch Ophthalmol* 2004;122:564–72.
6 García-Layana A, García-Arumí J, Figueroa MS, *et al*. Management of wet age-related macular degeneration in Spain: challenges for treat and extend implementation in routine clinical practice. *J Ophthalmol* 2019;2019:9821509.
7 García-Layana A, Garhöfer G, Aslam TM, *et al*. Exploring consensus on preventive measures and identification of patients at risk of age-related macular degeneration using the Delphi process. *J Clin Med* 2021;10:5432.
8 Lindsley KB, Hutfless S, Hawkins BS, *et al*. Evaluation of clinical questions and patient-important outcomes associated with the treatment of age-related macular degeneration. *JAMA Ophthalmol* 2018;136:1217–25.
9 Ferris FL, Wilkinson CP, Bird A, *et al*. Clinical classification of age-related macular degeneration. *Ophthalmology* 2013;120:844–51.
10 Gomes N, Meireles A, Carneiro Â, *et al*. A Delphi study on the clinical management of age-related macular degeneration. *Int Ophthalmol* 2022;42:1799–809.
11 Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *J Adv Nurs* 2000;32:1008–15.
12 Fitch K, ed. *The Rand/UCLA appropriateness method user's manual*. Santa Monica: Rand, 2001.
13 Shughoury A, Sevgi DD, Ciulla TA. The complement system: a novel therapeutic target for age-related macular degeneration. *Expert Opin Pharmacother* 2023:1–13.
14 Rudnicka AR, Jarrar Z, Wormald R, *et al*. Age and gender variations in age-related macular degeneration prevalence in populations of European ancestry: a meta-analysis. *Ophthalmology* 2012;119:571–80.
15 Age-Related Eye Disease Study Research Group. Risk factors associated with age-related macular degeneration. A case-control study in the age-related eye disease study: age-related eye disease study report number 3. *Ophthalmology* 2000;107:2224–32.
16 Corbelli E, Parravano M, Sacconi R, *et al*. Prevalence and phenotypes of age-related macular degeneration in eyes with high myopia. *Invest Ophthalmol Vis Sci* 2019;60:1394–402.
17 Klein R, Klein BEK, Franke T. The relationship of cardiovascular disease and its risk factors to age-related maculopathy: the beaver dam eye study. *Ophthalmology* 1993;100:406–14.
18 Jaffe GJ, Chakravarthy U, Freund KB, *et al*. Imaging features associated with progression to geographic atrophy in age-related macular degeneration: classification of atrophy meeting report 5. *Ophthalmology Retina* 2021;5:855–67.
19 Holz FG, Bindewald-Wittich A, Fleckenstein M, *et al*. Progression of geographic atrophy and impact of fundus autofluorescence patterns in age-related macular degeneration. *Am J Ophthalmol* 2007;143:463–72.
20 Fritsche LG, Igl W, Bailey JNC, *et al*. A large genome-wide association study of age-related macular degeneration highlights contributions of rare and common variants. *Nat Genet* 2016;48:134–43.
21 Brown MM, Brown GC, Sharma S, *et al*. The burden of age-related macular degeneration: a value-based analysis. *Curr Opin Ophthalmol* 2006;17:257–66.
22 Caswell D, Caswell W, Carlton J. Seeing beyond anatomy: quality of life with geographic atrophy. *Ophthalmol Ther* 2021;10:367–82.
23 Chakravarthy U, Bailey CC, Johnston RL, *et al*. Characterizing disease burden and progression of geographic atrophy secondary to age-related macular degeneration. *Ophthalmology* 2018;125:842–9.
24 Sunness JS, Rubin GS, Applegate CA, *et al*. Visual function abnormalities and prognosis in eyes with age-related geographic atrophy of the Macula and good visual acuity. *Ophthalmology* 1997;104:1677–91.
25 Fontenot JL, Bona MD, Kaleem MA, *et al*. Vision rehabilitation preferred practice pattern®. *Ophthalmology* 2018;125:P228–78.
26 van de Ven JPH, Nilsson SC, Tan PL, *et al*. A functional variant in the CFI gene confers a high risk of age-related macular degeneration. *Nat Genet* 2013;45:813–7.
27 Stanton CM, Yates JRW, den Hollander AI, *et al*. Complement factor D in age-related macular degeneration. *Invest Ophthalmol Vis Sci* 2011;52:8828–34.
28 Haines JL, Hauser MA, Schmidt S, *et al*. Complement factor H variant increases the risk of age-related macular degeneration. *Science* 2005;308:419–21.
29 Gold B, Merriam JE, Zernant J, *et al*. Variation in factor B (BF) and complement component 2 (C2) genes is associated with age-related macular degeneration. *Nat Genet* 2006;38:458–62.
30 Khanani A. Gather2 pivotal phase 3 study results: efficacy of intravitreal avacincaptad pegol in geographic atrophy; 2022.
31 Singh RP. Efficacy and safety of intravitreal Pegcetacoplanin GA: results from the phase 3 DERBY and OAKS trials. 2021.