



Treatment Preferences of Neurologists in Generalized Myasthenia Gravis: A Conjoint Analysis Study

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ABSTRACT

Introduction: Generalized myasthenia gravis (gMG) is a chronic autoimmune neuromuscular disorder for which treatment decision-making is increasingly complex due to the emergence of biologic targeted therapies. This study aimed to evaluate neurologists' treatment preferences in acetylcholine receptor seropositive gMG using

conjoint analysis to simulate real-world clinical decision-making.

Methods: We conducted a cross-sectional, web-based study among neurologists involved in the management of gMG in collaboration with the Spanish Society of Neurology. Participants were presented with eight hypothetical treatment scenarios comprising five key attributes: intensity of improvement, onset of action, duration of effect, adverse events, and route/frequency of administration. Utility values and importance of each attribute were estimated using ordinary least squares regression. Demographic, professional, and behavioral characteristics were

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assessed to explore variability in preference patterns.

Results: A total of 149 neurologists participated in the study. The mean age was 39.0 (SD 9.4) years, and 54.4% were male. Participants had a mean of 9.9 years (8.4) of experience treating patients with MG. The most valued treatment attribute was intensity of improvement (mean relative importance: 38.6%), followed by onset of action (21.5%) and duration of effect (17.4%). At the individual level, route and frequency of administration accounted for up to 21.9% of decision weight in some participants. Preferences were consistent across neuromuscular specialists and general neurologists but differed based on empathy and conscientiousness. Model fit was robust (Pearson's $R=1.000$, $p<0.001$).

Conclusions: Neurologists treating gMG placed the highest value on rapid and clinically meaningful symptom improvement, consistent with the therapeutic goals of emerging targeted therapies. However, substantial heterogeneity in preferences, especially regarding administration burden, emphasizes the need for individualized approaches and shared decision-making.

Keywords: Generalized myasthenia gravis; Preferences; Neurologists; Conjoint analysis; Targeted therapies; Decision-making

Key Summary Points

Generalized myasthenia gravis (gMG) is a rare autoimmune disease that has seen a rapid expansion in therapeutic options, including targeted therapies with diverse pharmacologic characteristics.

Treatment guidelines increasingly emphasize personalized approaches, but little is known about how neurologists weigh the trade-offs among efficacy, safety, speed of onset, and convenience when selecting therapies.

Neurologists treating patients with gMG primarily value therapies that deliver prompt and significant clinical improvement.

Understanding how neurologists prioritize treatment attributes may guide more patient-centered and evidence-informed care.

INTRODUCTION

Myasthenia gravis (MG) is a chronic autoimmune disease that impairs neuromuscular transmission by targeting the postsynaptic membrane of the neuromuscular junction [1–3]. In most cases, antibodies are directed against the acetylcholine receptor, leading to impaired signaling through receptor blockade, internalization, and complement activation. It typically presents fluctuating, activity-induced muscle weakness affecting the ocular, bulbar, respiratory, and proximal limb muscles. While MG can manifest in various ways, the generalized presentation (gMG) specifically refers to cases where muscle weakness extends beyond the ocular muscles. The estimated prevalence is 10–20 cases per 100,000 people, a figure that has risen over time because of improved diagnostics and increased survival [2, 4].

Historically, gMG treatment has relied on cholinesterase inhibitors, corticosteroids, and non-specific immunosuppressants such as azathioprine and mycophenolate mofetil [5, 6]. While these therapies can alleviate symptoms and modulate immune activity, they are associated with delayed onset, variable efficacy, and considerable side effects, such as infection risk, metabolic disturbances, and long-term organ toxicity [5, 7]. Their non-specific mechanism often leads to widespread immune suppression, which is particularly concerning in older or medically complex patients. In recent years, the emergence of targeted therapies, such as complement inhibitors, neonatal Fc receptor antagonists, and anti-CD19 monoclonal antibodies, has signaled a shift toward more precise, individualized treatment approaches [6, 8–10]. These newer agents differ in efficacy, safety, and mode of administration but also introduce new decision-making complexities related to onset of action, durability, tolerability, and alignment with patient-specific needs and preferences [8–16].

Although treatment guidelines continue to evolve, therapeutic choices are often influenced by the individual neurologist's experience and the patient's preferences [17–19]. Additional factors such as therapeutic inertia, risk aversion, and cognitive biases further complicate optimal decision-making [17, 20]. Understanding neurologists' preferences for specific treatment attributes is critical for ensuring that clinical strategies align both evidence and patient-centered outcomes. Considering the recent expansion of pharmacologic options, this study aimed to evaluate neurologists' treatment preferences in gMG using conjoint analysis (CA), a method designed to simulate real-world clinical decision-making [21].

METHODS

We conducted a non-interventional, cross-sectional, web-based study in collaboration with the Spanish Society of Neurology (SEN) to assess neurologists' preferences for key attributes of emerging biologic targeted treatments for acetylcholine receptor seropositive (AChR-ab+) gMG. Neurologists involved in the care of patients with MG were invited to participate via email through the SEN. The study was approved by the institutional review board of Hospital Clínico Universitario San Carlos (Madrid, Spain), and all participants provided electronic informed consent from April to July 2024.

Preferences were assessed using CA, a well-established method in healthcare research that evaluates how individuals prioritize treatment attributes based on trade-offs [17, 21]. Participants reviewed a series of hypothetical treatment scenarios, each consistent with a different combination of attribute levels, to simulate the types of complex trade-offs encountered in daily clinical practice. Attributes and levels were developed through a multi-step process, including a literature review of AChR-ab+ gMG targeted therapy clinical trials and input from seven neurologists with expertise in autoimmune neurologic disorders [9, 17, 22]. Five treatment attributes were ultimately selected: intensity of improvement, onset of action, duration of effect, adverse

events, and route and frequency of administration (Table 1).

- Intensity of improvement was defined by symptom change on the Myasthenia Gravis Activities of Daily Living (MG-ADL) scale, a validated eight-item patient-reported measure [23, 24]. A ≥ 2 -point reduction was used to denote clinically meaningful improvement [9, 17].
- Onset of action was categorized as rapid or delayed, reflecting the wide variation in therapeutic latency, from 1–2 weeks for newer agents to up to 18 months for traditional immunosuppressants [5, 9].
- Duration of effect was dichotomized into short (< 4 weeks) versus long (≥ 4 weeks), with longer durations expected to reduce relapses, hospitalizations, and treatment burden [8].
- Adverse events (AEs) were characterized by two levels based on the frequency and severity of side effects, ranging from common mild symptoms (e.g., headache, injection site reaction) to rare but serious complications (e.g., neoplasms, meningococcal infections) [7].
- Route and frequency of administration were treated as a single composite attribute with four levels, given its potential influence on both neurologist and patient preferences [8, 9].

An orthogonal design was used to generate eight unique treatment scenarios (Table 2), ensuring that attribute effects could be estimated independently. Scenarios were developed using the SPSS package to avoid correlation between attributes. The detailed protocol methodology has been published previously [17].

Study Flow

Participants were asked to rank the eight scenarios from one (most preferred) to eight (least preferred), enabling the assessment of trade-offs among distinct treatment features. Following this task, they provided information on their demographic and professional background and

Table 1 Treatment attributes

Attributes	Levels
Intensity of improvement	Improvement: $\geq 70\%$ of patients with ≥ 2 -point improvement in MG-ADL scale No improvement: $< 70\%$ of patients with ≥ 2 -point improvement in MG-ADL scale
Onset of action	Rapid onset: In 1–2 weeks after treatment start Late onset: In 3–18 months after treatment start
Duration of effect	Long: ≥ 4 weeks Short: < 4 weeks
Adverse events (AEs)	Frequent, but mild-to-moderate AEs Infrequent, but serious AEs
Route and frequency of administration	Subcutaneous daily Intravenous every 6 months Subcutaneous weekly for 4–6 weeks with repeated cycles according to the patient's course Intravenous every 8 weeks

AEs adverse events, *MG-ADL* Myasthenia Gravis Activities of Daily Living

completed a set of behavioral measures. These included resistance to change, healthcare-related regret (Regret Intensity Scale, RIS-10), burnout (using a validated single-item measure from the Physician Work Life Study), attitudes toward clinical risk, empathy (Jefferson Scale of Physician Empathy, JSPE), work engagement (Utrecht Work Engagement Scale, UWES), and personality traits (Big Five Inventory, BFI-10) [25–31]. Score ranges and cut-off points for these instruments are detailed in Table 3.

Statistical Analysis

Descriptive statistics were used to summarize all study variables. Continuous variables were reported using measures of central tendency (mean, median) and dispersion (standard deviation, interquartile range), while categorical variables were summarized using absolute counts and

percentages. An ordinary least squares regression model was applied to estimate utility values and to determine both relative and individual attribute importance. The relative importance of each attribute was calculated by dividing the range of utility values for that attribute by the total range across all attributes. Model fit was assessed using Pearson's *R* and Kendall's tau coefficients, which compare observed and predicted preferences. Bivariate analyses were performed to explore whether attribute importance varies according to participant characteristics. All statistical analyses were conducted using SPSS (version 19) and SAS Enterprise Guide (version 7.15).

RESULTS

A total of 185 neurologists agreed to participate in the study, with 149 (80.5%) ultimately being

Table 2 Set of treatment scenarios

Scenarios	Improvement of symptoms	Onset of action	Duration of effect		Safety	Route and frequency of administration
A	Improvement	Late onset	Long	Frequent, but mild-to-moderate AEs		IV every 8 weeks
B	No improvement	Late onset	Short	Frequent, but mild-to-moderate AEs		SC daily
C	Improvement	Late onset	Short	Infrequent, but serious AEs		SC weekly for 4–6 weeks with repeated cycles according to patient’s course
D	No improvement	Rapid onset	Short	Infrequent, but serious AEs		IV every 8 weeks
E	Improvement	Rapid onset	Short	Frequent, but mild-to-moderate AEs		IV every 6 months
F	Improvement	Rapid onset	Long	Infrequent, but serious AEs		SC daily
G	No improvement	Late onset	Long	Infrequent, but serious AEs		IV every 6 months
H	No improvement	Rapid onset	Long	Frequent, but mild-to-moderate AEs		SC weekly for 4–6 weeks with repeated cycles according to patient’s course

AEs adverse events, *IV* intravenous, *SC* subcutaneous

included in the analysis. Of those not included, 19 registered but did not enter any data, 8 withdrew their consent, and 9 did not complete the cases. The mean age was 39.0 years (standard deviation [SD] 9.4), and 54.4% were male. Participants had a mean of 9.9 years (8.4) of experience treating patients with MG. Most respondents (94.6%) worked in academic hospitals and reported seeing a median of 10.0 patients per month (interquartile range [IQR] 5.0–20.0). The sample characteristics are summarized in Table 3.

Among the eight treatment scenarios, Scenario E was most frequently identified as the preferred profile, being ranked first by 39.6% of the participants ($n=59$). Table 4 shows utility values for each attribute level. At the population level, the most influential attribute was intensity of improvement (38.6%), followed by onset of action (21.5%) and duration of effect (17.4%).

However, individual-level analysis showed that route and frequency of administration (21.9%) nearly matched the importance of onset of action (19.2%), indicating heterogeneity in how neurologists prioritize attributes.

Pearson’s R and Kendall’s τ showed perfect correlation values (1.000, $p<0.001$), confirming the robustness of the model fit. Utility estimates were consistent between neurologists with and without neuromuscular specialization (Table 5), but some differences emerged when stratified by demographic and behavioral traits (Table 6).

DISCUSSION

Patients with gMG experience significant functional impairment, impacting daily activities, productivity, and financial well-being [32–35].

Table 3 Main characteristics of participants

Characteristics	<i>N</i> = 149
Age, years, mean (SD)	39.0 (9.4)
Sex, male, <i>n</i> (%)	81 (54.4)
Years of experience as neurologist, mean (SD)	13.5 (8.6)
Years of experience treating patients with MG, mean (SD)	9.9 (8.4)
Degree of specialization, <i>n</i> (%)	
Neuromuscular specialist	48 (32.2)
Demyelinating diseases specialist	25 (16.8)
General neurologist treating MG patients	76 (51.0)
Type of hospital, academic, <i>n</i> (%)	141 (94.6)
Patients with MG treated per month, median (IQR)	10.0 (5.0–20.0)
Participation in MG clinical trials in the last 5 years, <i>n</i> (%)	38 (25.5)
Co-authorship of peer-reviewed publications in the last 3 years, <i>n</i> (%)	94 (63.1)
Attended neuromuscular congresses in the last year, <i>n</i> (%)	134 (89.9)
User resistance behavior score, mean (SD)	3.0 (0.8)
RIS-10 score, mean (SD)	20.6 (7.3)
Burnout, <i>n</i> (%)	27 (18.1)
Risk attitude, <i>n</i> (%)	90 (60.4)
JSPE score, mean (SD)	119.9 (11.1)
UWES score, mean (SD)	4.4 (0.9)
BFI-10 scores, mean (SD)	
Extraversion	3.3 (0.9)
Agreeableness	3.6 (0.6)
Conscientiousness	4.1 (0.6)
Neuroticism	2.5 (0.8)
Openness	3.8 (0.8)

Burnout: a single item ranging from 1 to 5. A score ≥ 3 is considered positive for burnout. Risk attitude: a single item ranging from 1 to 5. A score ≥ 3 indicates a risk-taker profile. User resistance behavior questionnaire: higher scores indicate greater resistance to change (range: 1–7). *BFI-10* Big Five Inventory (range: 1–5, higher scores indicate greater endorsement of each trait), *JSPE* Jefferson Scale of Empathy (range: 20–140, higher scores indicate greater empathy toward patients), *IQR* interquartile range, *MG* myasthenia gravis, *RIS-10* Regret Intensity Scale (range: 10–50, higher scores indicate greater regret intensity), *SD* standard deviation, *UWES* Utrecht Work Engagement Scale (range: 0–6, higher scores indicate greater work fulfilment)

Table 4 Utility scores and importance assigned to each attribute and level

Attributes	Utility estimation	Importance (relative) (%)	Importance (average) (%)
Intensity of improvement			
≥ 70% of patients with ≥ 2-point improvement in MG-ADL scale	1.158	38.6	30.3
< 70% of patients improve	− 1.158		
Onset of action			
1–2 weeks after treatment start	0.646	21.5	19.2
3–18 months after treatment start	− 0.646		
Duration of effect			
≥ 4 weeks	0.522	17.4	15.3
< 4 weeks	− 0.522		
Adverse events (AEs)			
Infrequent, but serious AEs	− 0.430	14.3	13.3
Frequent, but mild-to-moderate AEs	0.430		
Route and frequency of administration			
SC daily	− 0.315	8.1	21.9
IV every 6 months	0.171		
SC weekly for 4–6 weeks with repeated cycles	0.107		
IV every 8 weeks	0.037		
(Constant)	4.500		

AEs adverse events, *IV* intravenous, *MG-ADL* Myasthenia Gravis Activities of Daily Living, *SC* subcutaneous

Traditionally, gMG management has relied on corticosteroids and non-specific immunosuppressants, therapies often associated with delayed onset of action, variable efficacy, and considerable side effects [5–7]. Nearly half of patients may fail to achieve satisfactory control with these conventional treatments, indicating a substantial unmet need for more effective and safe therapeutic options [4, 9].

Our study reveals a critical shift in neurologists' therapeutic priorities for gMG, emphasizing rapid and substantial clinical improvement. The most influential attribute in treatment selection was intensity of improvement (38.6%), followed by onset of action (21.5%) and duration of effect (17.4%). This preference pattern

aligns with the clinical profiles of new targeted therapies, which offer more precise mechanisms of action and faster onset of treatment benefit compared to conventional immunosuppressants [8, 9, 21]. The high value placed on a ≥ 2-point improvement in the MG-ADL scale, considered a minimal clinically important difference, emphasizes the willingness for prompt and tangible patient benefit.

Complement inhibitors, including eculizumab, ravulizumab, and zilucoplan, intervene in the terminal complement cascade, mitigating the AChR antibody-mediated damage at the neuromuscular junction [4, 9]. These agents are associated with a rapid onset of action, with clinically meaningful improvements in

Table 5 Utility scores and importance assigned to each attribute and level by degree of specialization

Variable	Utility estimation			Importance (relative) (%)			Importance (averaged) (%)		
	NMS (<i>n</i> = 48)	DDS (<i>n</i> = 25)	GN_MG (<i>N</i> = 76)	NMS (<i>n</i> = 48)	DDS (<i>n</i> = 25)	GN_MG (<i>N</i> = 76)	NMS (<i>n</i> = 48)	DDS (<i>n</i> = 25)	GN_MG (<i>N</i> = 76)
Intensity of improvement									
≥ 70% of patients with ≥ 2-point improvement in MG-ADL scale	1.193	1.110	1.151	41.9	32.5	37.4	33.3	27.0	29.4
< 70% of patients improve	− 1.193	− 1.110	− 1.151						
Onset of action									
1–2 weeks after treatment starts	0.604	0.810	0.618	21.2	23.7	20.1	17.7	20.0	19.9
3–18 months after treatment starts	− 0.604	− 0.810	− 0.618						
Duration of effect									
≥ 4 weeks	0.427	0.630	0.546	15.0	18.4	17.7	14.6	15.3	15.7
< 4 weeks	− 0.427	− 0.630	− 0.546						
Adverse events (AEs)									
Infrequent, but serious AEs	− 0.318	− 0.470	− 0.487	11.2	13.7	15.8	12.3	13.5	13.8
Frequent, but mild-to-moderate AEs	0.318	0.470	0.487						
Route and frequency of treatment administration									
SC daily	− 0.302	− 0.420	− 0.289	10.8	11.7	9.0	22.1	24.1	21.1
IV every 6 months	0.000	0.220	0.263						
SC weekly for 4–6 weeks with repeated cycles	− 0.010	0.380	0.092						
IV every 8 weeks	0.313	− 0.180	− 0.066						

Differences not statistically significant ($p > 0.05$)

AEs adverse events, *DDS* demyelinating diseases specialist, *IV* intravenous, *GN_MG* general neurologist, *MG-ADL* Myasthenia Gravis Activities of Daily Living, *NMS* neuromuscular specialist, *SC* subcutaneous

MG-specific outcome measures such as the MG-ADL scale typically observed within 2 weeks, and Quantitative Myasthenia Gravis score improvements emerging by 4 weeks. Zilucoplan has demonstrated early and sustained efficacy over extended periods, while ravulizumab offers a prolonged therapeutic effect with a dosing schedule of every 8 weeks. In parallel, Fc antagonists such as efgartigimod and rozanolixizumab

reduce circulating IgG, including pathogenic autoantibodies, by preventing their recycling [4, 9]. Both therapies lead to symptomatic improvement within 2–4 weeks. Efgartigimod requires repeated treatment cycles for continued efficacy, whereas rozanolixizumab shows benefit in both patients with AChR and muscle-specific kinase antibodies. Together, these agents represent a significant evolution in gMG therapy, offering

Table 6 Importance assigned to each attribute and level by participants characteristics

Variable	<i>N</i>	Intensity of improvement	Onset of action	Duration of effect	Adverse events	Route and frequency of administration
Sex						
Male	81	32.53 (18.77)	17.52 (12.23)	15.22 (12.43)	11.45 (9.37)	23.28 (13.68)
Female	68	27.64 (18.09)	21.24 (13.82)	15.30 (13.03)	15.47 (12.68)	20.35 (10.52)
<i>p</i> value		0.1095	0.0833	0.9704	0.0279	0.1510
BFI-10 (conscientiousness ^a)						
< 4	33	36.29 (18.01)	18.37 (10.33)	10.89 (10.10)	10.39 (7.25)	24.06 (13.48)
≥ 4	116	28.59 (18.44)	19.46 (13.78)	16.50 (13.08)	14.11 (11.93)	21.34 (12.05)
<i>p</i> value		0.0342	0.9763	0.0137	0.2085	0.2327
JSPE total score ^a						
< 121	62	31.03 (19.17)	19.16 (12.34)	13.18 (10.88)	12.20 (9.46)	24.42 (13.62)
≥ 121	87	29.77 (18.21)	19.26 (13.63)	16.74 (13.66)	14.05 (12.21)	20.18 (11.17)
<i>p</i> value		0.6834	0.9650	0.0906	0.3206	0.0390

^aCategorization according to the median*BFI-10* Big Five Inventory, *JSPE* Jefferson Scale of Physician Empathy

prompt symptom relief and durable responses with mechanistically targeted approaches.

This emphasis on efficacy is consistent with findings in other chronic neuroimmunologic conditions where relapse rate, disability progression, or symptom burden significantly impacts daily life, such as multiple sclerosis and neuromyelitis optica spectrum disorder [36, 37]. Studies examining neurologist preferences in these diseases similarly identified efficacy as central attributes in treatment selection. This suggests a common underlying principle in neurology: clinicians prioritize treatments that offer clear, measurable clinical benefit and disease control.

While efficacy attributes were critical at the group level, our findings also highlighted significant heterogeneity in preferences, particularly concerning the route and frequency of administration. For a subset of neurologists, administration burden accounted for up to 21.9% of their decision weight at the individual level, nearly matching the importance of onset of action. This variability likely reflects practical considerations in clinical practice, such as

the perceived convenience of self-administered subcutaneous formulations versus the logistical demands of frequent intravenous infusions as well as the diverse needs and preferences of individual patients [17]. The evolving landscape of gMG-targeted options offers diverse administration formats, including daily subcutaneous injections, intravenous dosing every 8 weeks, and investigational long-acting subcutaneous therapies [5, 9].

Furthermore, our study explored the influence of behavioral and personality traits on treatment preferences. Neurologists scoring high on conscientiousness placed greater importance on sustained efficacy, which suggests a focus on long-term disease stability and relapse prevention. Conscientiousness is a personality trait characterized by orderliness, dutifulness, and goal orientation [38]. In physicians, high levels of conscientiousness are often associated with perfectionism, which may contribute to diligence and accuracy in patient management. Conversely, neurologists with lower empathy scores assigned greater

weight to the route and frequency of administration. This finding, while seemingly counter-intuitive at first glance, may suggest that these clinicians are highly attuned to the practical burdens and lifestyle impacts that different administration methods impose on patients. Rather than indicating a lack of concern, this emphasis on administration burden could reflect a focus on concrete, tangible aspects of care that directly influence a patient's daily life and treatment adherence. These findings underscore that objective clinical data do not solely drive physician decision-making but are also shaped by individual psychologic characteristics, a concept increasingly recognized in medical decision science. Prior research has also linked physician personality traits and cognitive biases to variations in therapeutic inertia and risk tolerance, further complicating optimal decision-making [20, 39, 40]. The influence of empathy on patient satisfaction, treatment compliance, and clinical outcomes is well documented [41]. High levels of empathy among neurologists were associated with greater openness to adopting new evidence-based practices [40]. This suggests that an empathetic approach can improve patient engagement and health outcomes.

The findings of this study have several important implications. For clinical practice, the observed prioritization of rapid and substantial improvement supports guideline updates advocating early use of targeted therapies in moderate-to-severe gMG, particularly given the significant burden of uncontrolled disease [9, 16]. However, the substantial heterogeneity in preferences, especially regarding administration burden, highlights the critical need for individualized treatment approaches and robust shared decision-making processes. Clinicians should actively engage patients in discussions about their preferences for administration route and frequency, balancing these with efficacy and safety profiles. A recent discrete-choice experiment in patients with gMG from the UK, Germany, and the US found that self-administration at home was preferred to administration in a healthcare facility, even over a faster onset of action in some scenarios [7]. This further emphasizes the importance of

incorporating patient preferences into treatment selection to optimize adherence and outcomes [42].

This study has several limitations. First, in the absence of extensive prior research on neurologist preferences in this rapidly evolving treatment landscape, our selection of attributes was guided primarily by clinical trial data and expert opinion, which may not encompass all relevant decision-making factors for every neurologist. As a result, some attributes of importance to individual neurologists might have been omitted. Additionally, like all preference studies, the hypothetical nature of conjoint scenarios may not perfectly reflect the complexities of real-world clinical practice. We also acknowledge that our study did not include cost as a direct attribute. We recognize that cost is a major limiting factor in treatment choice, particularly in regions where these therapies may not be available, and even in developed countries where it can place a heavy burden on healthcare systems. Furthermore, a key limitation is the composition of our sample, as most participants worked in academic hospitals. While these settings are the most likely to prescribe targeted therapies, this characteristic may limit the generalizability of our findings to neurologists in non-academic practice.

CONCLUSIONS

Our findings suggest that neurologists treating gMG increasingly prioritize rapid, clinically meaningful symptom control, reflecting the capabilities of new targeted therapies. However, heterogeneity exists, influenced by clinician characteristics and practical considerations related to administration burden. As biologics redefine MG care, integrating patient preferences, minimizing treatment burden, and supporting shared decision-making will be critical to ensuring effective implementation in daily clinical practice.

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Data Availability. The datasets generated during the analysis of the study are available from the corresponding author on reasonable request.

Declarations

Conflict of Interest. Luis Querol reports receiving speaker honoraria from Merck, Sanofi, Roche, Biogen, Grifols, and CSL Behring; providing expert testimony for Grifols, Johnson & Johnson, Annexon Pharmaceuticals, Sanofi, Novartis, Takeda, and CSL-Behring; and receiving research funds from Roche, UCB, and Grifols. Gerardo Gutiérrez-Gutiérrez reports receiving consulting fees from CSL Behring, Biogen, Alter, Takeda, Akcea, Lupin Neuroscience, Roche, Alexion, and Argenx; congress support from Alter, Esteve, Sanofi-Genzyme, Pfizer, and UCB Pharma; scientific collaborations with Lilly, Alexion, Genzyme, Takeda, Biogen, Pfizer, and Alter; royalties from books published with Exeltis, Alter, Esteve, Andrómaco, and Bristol-Myers; and grants and awards from Lilly, UCB

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Ethical Approval. The study was approved by the institutional review board of Hospital Clínico Universitario San Carlos (Madrid, Spain).

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