

An investigation of the economic burden of treatment for nAMD/DME on treatment recipients and caregivers in the United States

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Key Question

- What is the economic burden of intravitreal (IVT) injection of anti-vascular endothelial growth factor (anti-VEGF) treatment from the perspective of patients with neovascular age-related macular degeneration (nAMD)/diabetic macular edema (DME) and caregivers of patients with nAMD/DME?

Introduction

- nAMD and DME are ocular conditions that can lead to irreversible vision loss if treated sub-optimally (1)
- IVT injection of anti-VEGF agents is the standard of care for people with nAMD and DME in the United States (2, 3)
- Frequent injections are required to maintain vision, and can cause considerable burden and productivity loss in those receiving IVT, and their informal caregivers

Methods

- Data were collected from adult patients with nAMD/DME and informal caregivers in the United States using a survey (via online self-completion, telephone-assisted survey, or mailed-out pen and paper modes of administration) between September and December 2022
 - Two surveys were developed—one for patients with nAMD/DME and one for caregivers
 - Each survey contained bespoke questions to collect data on demographic characteristics vision-related quality of life (VFQ-SF)^a and care-related quality of life (CarerQoL)^b, and to calculate economic burden
 - Data from respondents who reported that they were currently receiving IVT anti-VEGF treatment were analysed using descriptive statistics
 - Data were combined with unit costs to calculate total economic burden over 6 months
 - Annual economic burden was calculated by doubling 6-month economic burden for all respondents
 - Generalized linear model (GLM) regression analysis examined predictors of economic burden
- ^a Short-form visual function questionnaire, ^b care-related quality of life questionnaire

Results

- A total of 157 responses were collected (75 patients, 82 caregivers). Approximately 63% of the sample (n=99; n=45 patients and n=54 caregivers) reported currently receiving IVT anti-VEGF treatment
- Most caregivers (n=27, 50%) in the sample cared for either their mother or father and most (n=24, 44%) caregivers worked full-time (*Table 1*)
- Most patients in the sample (n=22, 49%) were covered by private health insurance (*Table 1*)
- Most patients received anti-VEGF injections monthly and received treatment from a private clinic (*Figure 1*)
- Mean total financial costs to patients and caregivers in the previous 6 months were \$733 and \$2423, respectively. For both patients and caregivers, financial costs were the largest contributor to total economic burden. The largest contributor to financial costs for both patients and caregivers was medication costs (*Table 2*)
- Mean total productivity losses to patients and caregivers in the previous 6 months were \$105 and \$445, respectively. The largest contributor to productivity losses for patients was the opportunity cost of time attending treatment visits, and for caregivers was the opportunity cost of travelling to accompany patients to treatment visits (*Table 3*)
- Both total 6 month economic burden and productivity losses were larger for caregivers (\$2868 and \$445, respectively) than patients (\$838 and \$105, respectively) (*Tables 3 and 4*)
- Mean composite VFQ-SF score for patients receiving anti-VEGF treatment was 57 out of 100, mean composite CarerQoL score for caregivers was 82 out of 100, and mean visual analogue score (VAS) of self-reported happiness was 8 out of 10 (*Figure 2*)
- Regression analysis of economic burden demonstrated that an injection frequency of every 12 weeks had the largest estimated impact on reducing economic burden for the pooled sample of patients and caregivers, controlling for other covariates (*Table 5*)

Limitations & Conclusions

Limitations

- Self-reported surveys are limited by risk of recall bias among respondents; response outliers cannot be distinguished as data error vs genuine
- Small sample sizes of respondents limits generalizability of results

Conclusions

- Receiving anti-VEGF treatment places a substantial economic burden on patients with nAMD/DME and in caregivers. Frequent treatment visits place burden on both finances and time
- Results suggest that the burden is greater on caregivers than patients, though caregiver burden is often not considered in evaluations of new medical technologies.
- Adjusted analyses demonstrated 12-week dosing to estimate the largest impact on reducing economic burden for the pooled sample of patients and caregivers. More durable agents to treat nAMD and DME could support reduced societal costs.

Table 1. Demographic characteristics of the patients with nAMD/DME currently receiving anti-VEGF treatment and caregivers of patients with nAMD/DME currently receiving anti-VEGF treatment

	Patients (n=45)				Caregivers (n=54)			
	nAMD, n=36	DME, n=9	nAMD, n=34	DME, n=20	nAMD, n=36	DME, n=9	nAMD, n=34	DME, n=20
	n	%	n	%	n	%	n	%
Age [Mean (SD)]	69	(8)	62	(6)	45	(15)	38	(8)
Gender								
Male	19	53%	2	22%	22	65%	12	60%
Female	15	42%	7	78%	12	35%	8	40%
Prefer not to say	2	6%	0	0%	0	0%	0	0%
Relationship of patient to caregiver								
Partner/Spouse					10	29%	3	15%
Mother/Father					17	50%	10	50%
Brother/Sister (including in-laws)					3	9%	0	0%
Other Family Member					2	6%	2	10%
Friend/Neighbour					2	6%	3	15%
Prefer not to answer					0	0%	2	10%
Hispanic, Latino, or Spanish ethnicity								
Another Hispanic, Latino, or Spanish origin	0	0%	1	13%	0	0%	0	0%
Mexican, Mexican American, Chicano	0	0%	0	0%	9	26%	1	5%
Cuban	0	0%	0	0%	1	3%	0	0%
Puerto Rican	0	0%	0	0%	0	0%	1	5%
Race								
White	29	81%	7	78%	22	65%	14	70%
Black or African American	3	8%	1	11%	10	29%	6	30%
Pacific Islander	4	11%	1	11%				
American Indian or Alaska native	0	0%	0	0%	1	3%	0	0%
Another race/more than one race	0	0%	0	0%	1	3%	0	0%
Employment status ^a								
Full-time work	5	14%	2	20%	16	47%	9	35%
Part-time work	6	19%	1	11%	5	15%	7	27%
Self-employed	4	11%	1	10%	5	15%	2	8%
Student	0	0%	0	0%	2	6%	1	4%
Retired	20	54%	4	40%	4	12%	4	15%
Unemployed	2	5%	2	20%	4	12%	4	15%
Health insurance coverage								
Private healthcare insurance	19	53%	3	33%				
Medicaid	1	3%	2	22%				
Medicare	14	39%	3	33%				
CHAMPVA or Veteran's Affairs	1	3%	0	0%				
Uninsured	1	3%	0	0%				
Prefer not to say	0	0%	1	11%				
Community								
Urban	22	61%	3	33%	20	59%	6	30%
Rural	3	8%	2	22%	2	6%	4	20%
Suburban	11	31%	4	44%	12	35%	10	50%
Income threshold ^c								
Low income	13	36%	5	56%	8	24%	2	10%
Middle income	20	56%	3	33%	11	32%	13	65%
High income	3	8%	1	11%	15	44%	5	25%

CHAMPVA, Civilian Health and Medical Program of the Department of Veteran's Affairs; DME, diabetic macular edema; nAMD, neovascular age-related macular degeneration; SD, standard deviation; VEGF, vascular endothelial growth factor

% represents the percentage of respondents reporting each variable category within the eye condition group (nAMD/DME) of each respondent sample (patients or caregivers).

^a Respondents were able to select >1 option for employment status; therefore, the percentage may total up to >100%. ^b Question only presented to patients. ^c Low income: <\$50,000; middle income: \$50,000-\$150,000; high income: >\$150,000

Table 2. Total financial costs and the components of financial costs associated with anti-VEGF treatment to patients and caregivers over the past 6 months

	Transport costs ^a (\$)			Direct healthcare costs ^b (\$)			Medication costs ^c (\$)			Total financial costs ^d		
Patients with nAMD/DME												
	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total
n	36	9	45	36	9	45	36	9	45	36	9	45
Mean	158	100	147	136	120	132	378	760	454	671	981	733
SD	289	101	262	199	103	183	1010	1653	1155	1094	1674	1216
Caregivers of patients with nAMD/DME												
	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total
n	34	20	54	34	20	54	34	20	54	34	20	54
Mean	724	226	540	333	500	395	1654	1206	1488	2711	1933	2423
SD	1054	235	878	328	625	462	3165	2368	2880	4106	2545	3601

DME, diabetic macular edema; nAMD, neovascular age-related macular degeneration; SD, standard deviation; VEGF, vascular endothelial growth factor

^a Amount spent to travel to all appointments for anti-VEGF treatment in the past 6 months (e.g., taxi/public transport fares, parking and tolls, mileage, etc); ^b Amount spent at healthcare visits for anti-VEGF treatment in the past 6 months as direct healthcare purchase / co-payment / deductible; ^c Amount spent on over the counter or prescription medications in the past 6 months for treatment for nAMD / DME; ^d Transport, direct healthcare, and medication costs combined over the past 6 months

Transport cost data (public transport fares, taxi fares, parking or toll road charges, contribution to community transport), direct healthcare costs data, and medication costs data all derived from self-report by patients and caregivers. Mileage (distance) data provided by self-report and cost per mile from IRS 2022 mileage rate of 62.5 cents per mile applied to generate cost of distance travelled.

Table 3. Total productivity losses and the components of productivity losses associated with anti-VEGF treatment to patients and caregivers over the past 6 months

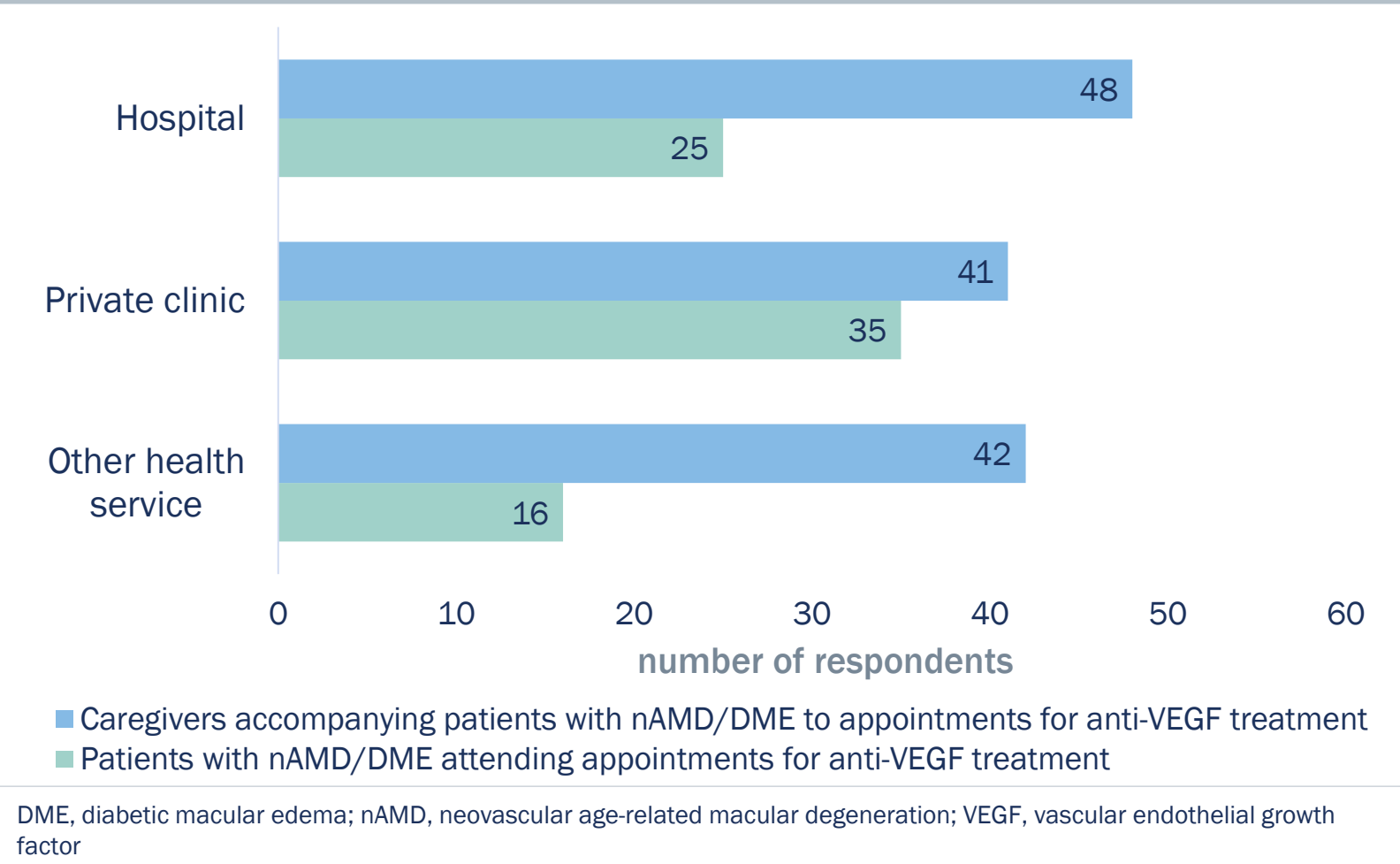
	Travel time ^a (hours)			Travel opportunity cost ^b (\$)			Visit time ^c (hours)			Visit opportunity cost ^d (\$)			Total productivity losses (\$)		
Patients with nAMD/DME															
	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total
n	36	9	45	36	9	45	36	9	45	36	9	45	36	9	45
Mean	4	5	4	39	76	46	5	6	6	50	93	59	89	168	105
SD	3	5	4	37	103	57	4	4	4	38	107	59	67	198	108
Caregivers of patients with nAMD/DME															
	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total	nAMD	DME	Total
n	34	20	54	34	20	54	34	20	54	34	20	54	34	20	54
Mean	24	27	25	211	285	238	22	19	21	206	208	207	417	493	445
SD	37	44	39	264	352	298	24	17	21	180	189	182	410	479	434

DME, diabetic macular edema; nAMD, neovascular age-related macular degeneration; SD, standard deviation

^a Total time spent travelling to and from anti-VEGF treatment appointments in the past 6 months; ^b Total monetary cost of time spent travelling to anti-VEGF appointments in the past 6 months based on activity displaced (e.g., paid work, unpaid work or leisure time); ^c Total time spent at visits for anti-VEGF treatment in the past 6 months; ^d Total monetary cost of time spent at visits for anti-VEGF appointments in the past 6 months based on activity displaced (e.g., paid work, unpaid work or leisure time)

Time data derived from patient and caregiver self-report. Opportunity cost calculated by multiplying time spent by the shadow price of the activity foregone (reported by patients and caregivers). Shadow prices taken from available data, i.e., paid work: BLS average hourly wage rate for 2022 (\$30.41), unpaid work and leisure time: BLS hourly minimum wage for 2022 (\$7.25)

Figure 1. Patients receiving anti-VEGF treatment at each health service in the past 6 months and caregivers accompanying patients to each health service



DME, diabetic macular edema; nAMD, neovascular age-related macular degeneration; VEGF, vascular endothelial growth factor

Table 4. 6 month economic burden and annual economic burden for patients with nAMD/DME and caregivers of patients with nAMD/DME

	6 month economic burden (\$)			Annual economic burden (\$)		
Patients with nAMD/DME						
	nAMD	DME	Total	nAMD	DME	Total
n	36	9	45	36	9	45
Mean	760	1149	838	1520	2298	1676
SD	1097	1677	1222	2194	3354	2444
Caregivers of patients with nAMD/DME						
	nAMD	DME	Total	nAMD	DME	Total
n	34	20	54	34	20	54
Mean	3128	2426	2868	6256	4851	5736
SD	4369	2551	3786	8738	5102	7572

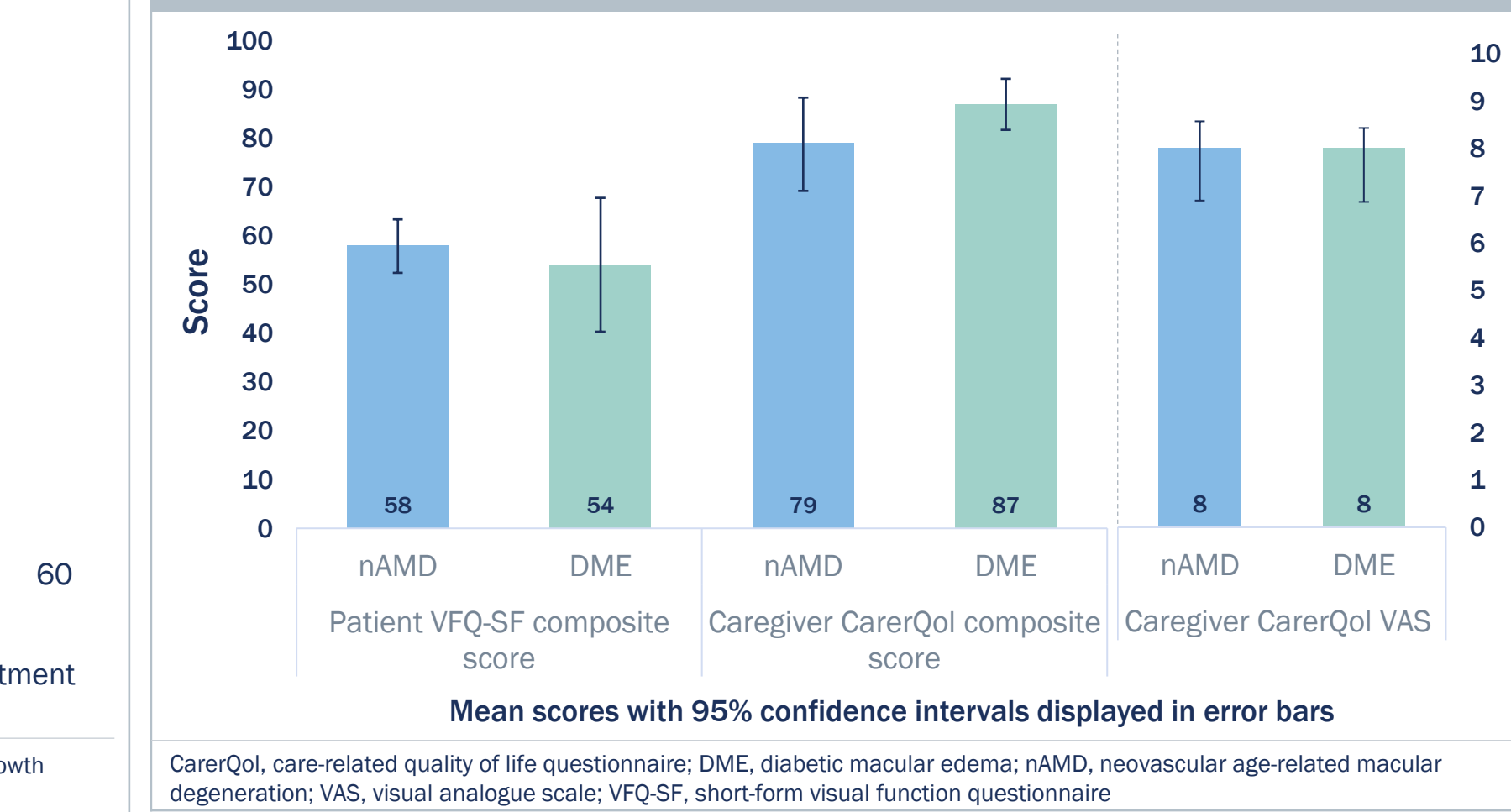
DME, diabetic macular edema; nAMD, neovascular age-related macular degeneration; SD, standard deviation

6 month economic burden calculated by summing financial costs and productivity losses. Annual economic burden calculated by doubling 6-month economic burden for all respondents.

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- AA: Speaker, Genentech

Figure 2. Mean composite scores for VFQ-SF (0-100), CarerQoL (0-100), and CarerQoL VAS (0-10) by eye condition



Mean scores with 95% confidence intervals displayed in error bars

CarerQoL, care-related quality of life questionnaire; DME, diabetic macular edema; nAMD, neovascular age-related macular degeneration; VAS, visual analogue scale; VFQ-SF, short-form visual function questionnaire

Table 5. Generalized linear model regression analysis of 6 month economic burden against various covariates

Covariate	Dependent variable		
	Base case economic burden (\$), patients (n=37)	Base case economic burden (\$), caregivers (n=47)	Base case economic burden (\$), caregivers and patients pooled (n=84)
Time receiving current treatment			
More than 12 months	-0.368 (1.418)	1.091** (0.529)	1.041** (0.407)
Time since first injection			
More than 12 months ago	0.956 (2.439)	-1.880** (0.822)	-0.655 (0.565)
Frequency of injections			
Every 12 weeks	-0.291 (2.859)	-0.481 (0.954)	-1.517*** (0.541)
Community			
Rural	2.548 (2.344)	-0.750 (0.951)	-0.971* (0.547)
Constant	-1.418 (5.447)	8.903*** (1.111)	8.146*** (0.915)

Standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1. DME, diabetic macular edema; nAMD, neovascular age-related macular degeneration. Reference categories: Time receiving current treatment, 12 months or less; Time since first injection, Less than 1 month ago; Frequency of injection, Every 4 weeks; Community, Urban

Only significant results are shown in the table. Other covariates and factors included in the models are not displayed are: Eye condition (nAMD, DME); Gender (Male, Female, Prefer not to say); Age, Respondent group (Patient, Caregiver); Time since first injection (1-6 months ago, 7-12 months ago, Unsure); VFQ-SF (short-form visual function questionnaire) score; Frequency of injections (Every 8 weeks, Every 16 weeks, Treatment as required); Number of injections in past 6 months (1 to 3 injections, 4 or 5 injections, 6 or more injections); CarerQoL score; Number of affected eyes (unilateral, bilateral); Insurance coverage (Private health insurance, Medicaid, Medicare, Uninsured); Employment status (Working full-time, Working part-time, Self-employed, Retired, Unemployed, Prefer not to say, More than 1 employment option chosen); Income category (Low income (<\$50,000), middle income (\$50,000-\$150,000), high income (>\$150,000)); Community (Suburban)

Study disclosures

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