

# OPTIC Study of Intravitreal Gene Therapy With ADVM-022 for Neovascular Age-related Macular Degeneration

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– On behalf of the OPTIC investigators –

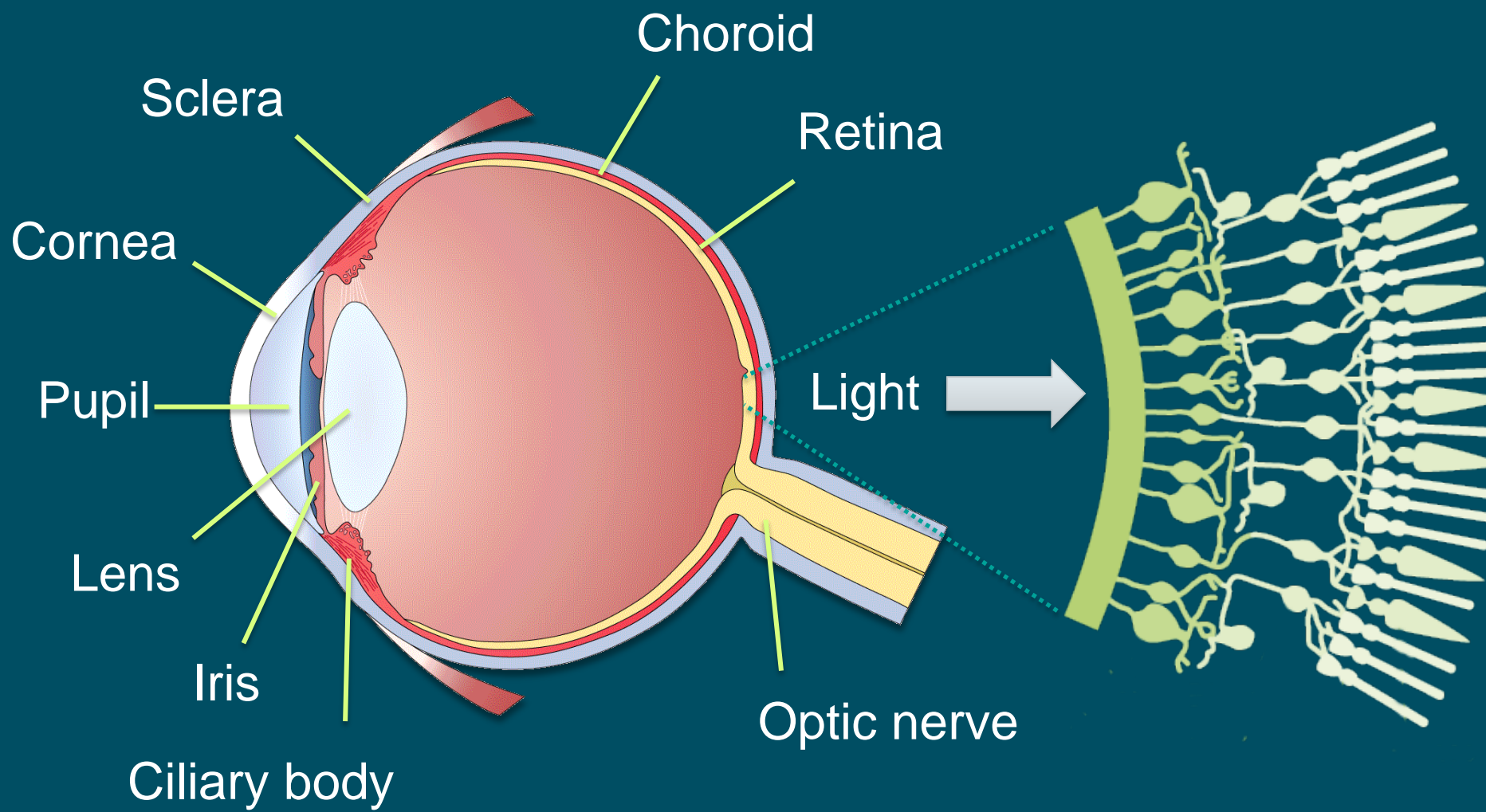


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# Disclosures

- Adverum Biotechnologies – Consultant/Advisor, Equity
- Regenxbio – Consultant/Advisor, Equity
- Genentech/Roche – Consultant/Advisor
- Fortress Bio – Consultant/Advisor, Equity
- Optos – Consultant/Advisor, Research grant support
- Novartis – Consultant/Advisor
- Intellectual Property related to gene and cellular therapy – assigned to Weill Cornell/Cornell University

# Schematic of Human Eye



# Neovascular AMD: Large Patient Population with Significant Opportunity to Improve Vision

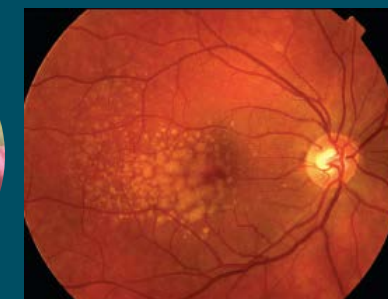
## Neovascular AMD

- Neovascular age-related macular degeneration is a progressive, degenerative disease that can lead to serious vision loss
- Vision loss from abnormal blood vessel proliferation and leakage due in part to VEGF activity
- Standard of care – regular intravitreal injections of anti-VEGF therapy

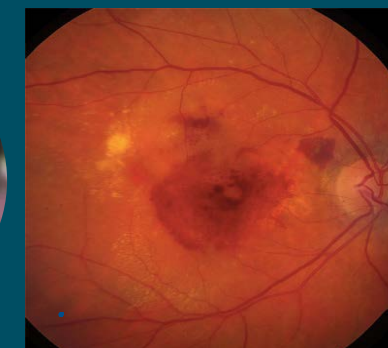
## Patient population

- 1.2M U.S. patients,<sup>1</sup> 3M globally

### Intermediate AMD – 20/20-20/30 Vision



### Neovascular AMD at Diagnosis – 20/80 Vision



# Largest Clinical Unmet Need: Less Frequent Injections

Largest unmet needs for nAMD patients  
(Number of mentions, N=30^)



“ The single, largest unmet need is the durability of the medication... the need to develop systems with longer acting treatments... we want to **reduce the treatment burden to prevent people from coming in every 4-8 weeks** ”

Retina Specialist

“ In general, medicines are fairly effective... **The biggest issue is durability. Especially for elderly patients that have trouble getting to appointments** ”

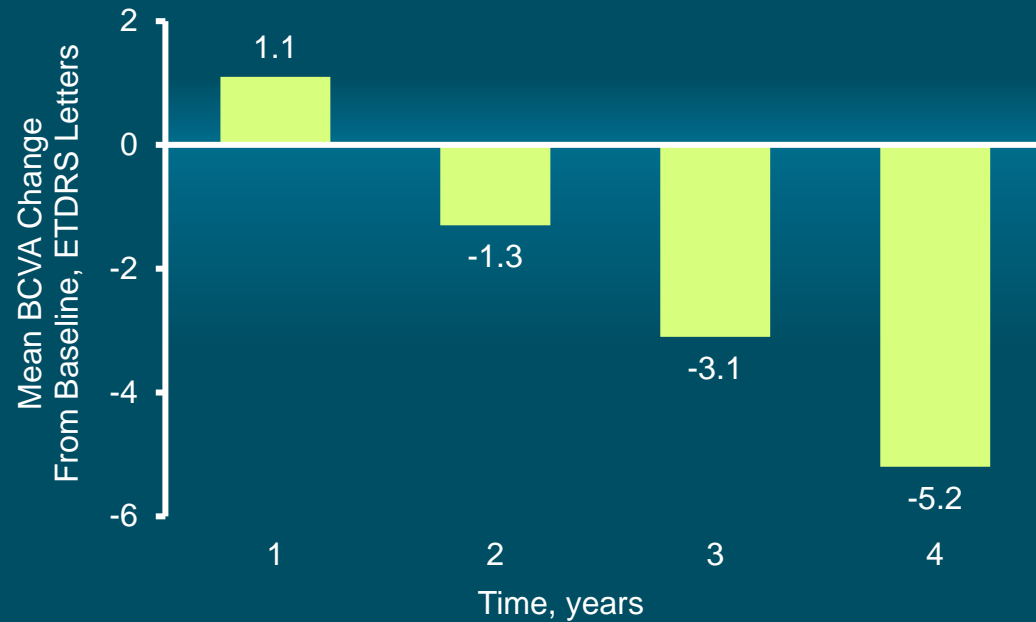
Retina Specialist

# Real-world anti-VEGF Patient Outcomes

*Undertreatment leads to vision loss over time*

98,821 Eyes from 79,885 US Patients  
Receiving Routine Intravitreal anti-VEGF Therapy

Development Approach to Deliver  
Long-Term Efficacy



# of Injections	1	2	3	4
	7.5	6.7	6.6	6.4

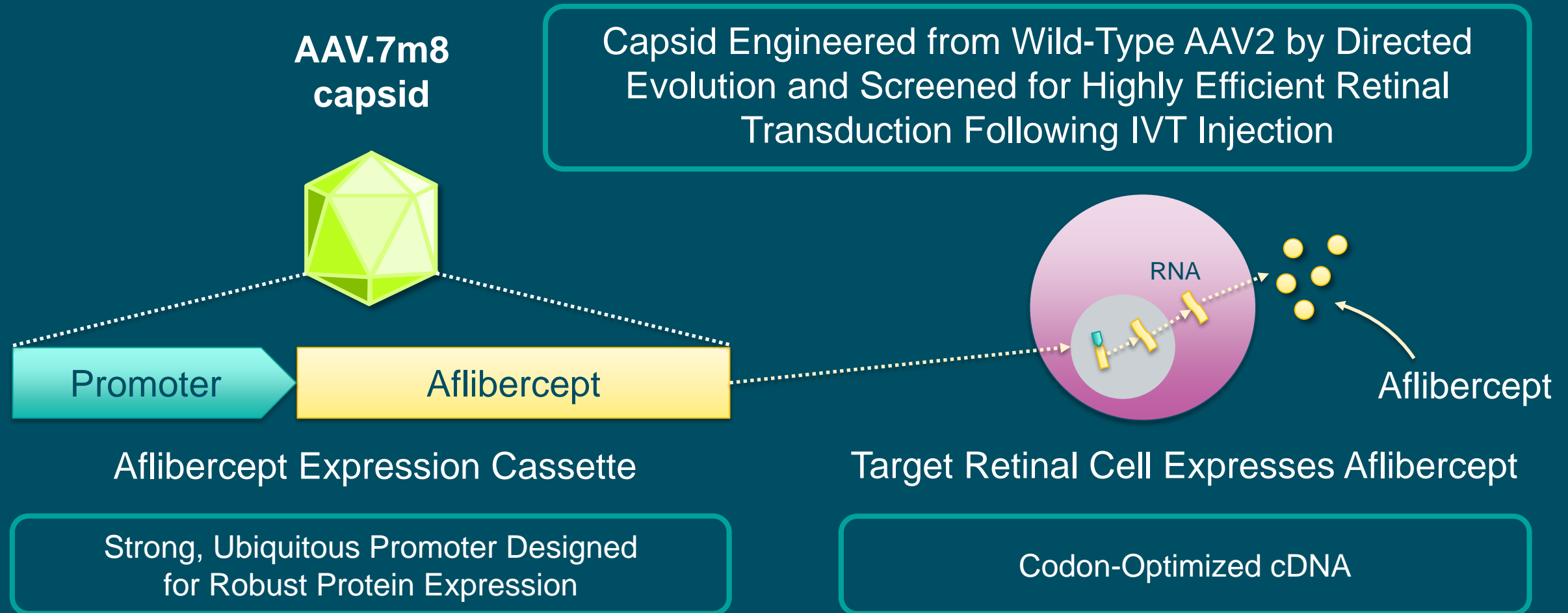


## Gene Therapy

In-Office Intravitreal Injection  
to Establish an Intraocular  
anti-VEGF Biofactory

# ADVM-022: 7m8 Adeno-Associated Virus Gene Therapy Vector

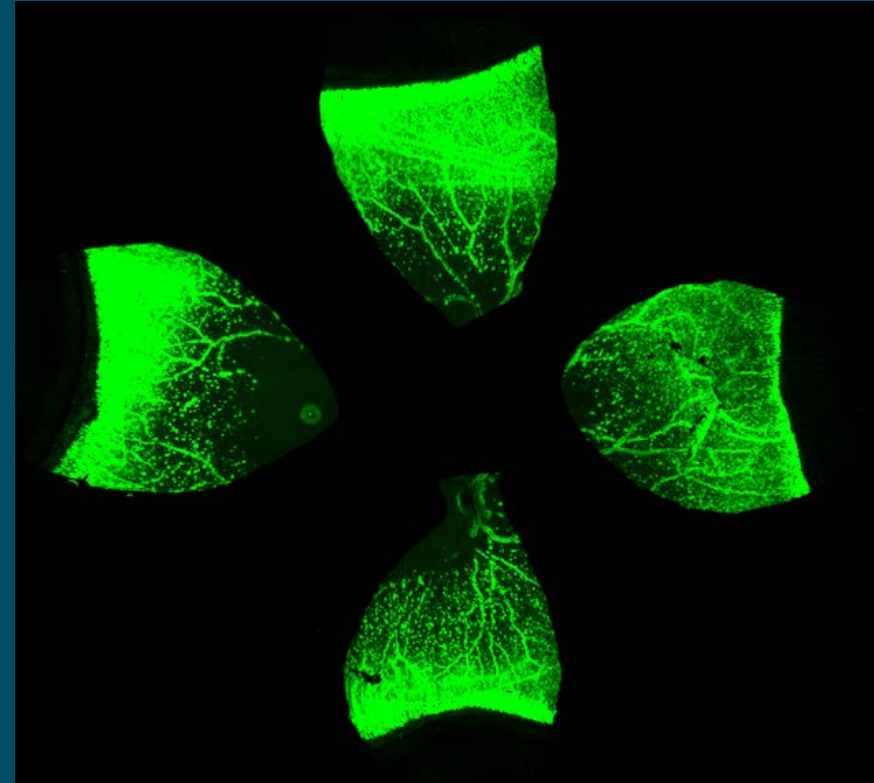
*Designed for continuous delivery of aflibercept by intravitreal injection*





# Intravitreal Injection of AAV.7m8 Results in Robust Cellular Transduction and Protein Expression in the Eye

- Advanced AAV.7m8 vector developed using directed evolution to:
  - Enable efficient intravitreal delivery<sup>1,3</sup>
  - Increase transduction of retinal cells<sup>1,3</sup>
  - Increase protein expression<sup>1</sup>
- Protein expression in NHPs:
  - Photoreceptors, ganglion cells<sup>1–3</sup>
  - Bipolar cells, Müller cells, optic nerve<sup>2</sup>
  - Ciliary epithelium, iris pigment epithelium<sup>2</sup>



Green Fluorescent Protein Expression In  
Non-Human Primate Retina<sup>1</sup>



# OPTIC Study: Evaluating ADVM-022 in Treatment Experienced Patients with nAMD

## Status

- 4 cohorts fully enrolled
- Follow-up to 104 weeks

## Primary Objective

- Assess the safety and tolerability of a single IVT injection of ADVM-022

## Secondary Objective

- Evaluate vision maintenance (BCVA)
- Evaluate anatomy (SD-OCT)
- Assess the need for supplemental therapy



## Prophylaxis Steroid Regimen

<b>Cohort 1</b> (n=6) 6 x 10 <sup>11</sup> high dose	Oral*, 13d
<b>Cohort 2</b> (n=6) 2 x 10 <sup>11</sup> low dose	Oral*, 13d
<b>Cohort 3</b> (n=9) 2 x 10 <sup>11</sup> low dose	Eye Drops**, 6wks
<b>Cohort 4</b> (n=9) 6 x 10 <sup>11</sup> high dose	Eye Drops**, 6wks

## Supplemental Aflibercept (2 mg IVT) Criteria:

1. Loss of  $\geq 10$  letters in BCVA (ETDRS) from baseline that is attributed to intraretinal or subretinal fluid observed by the investigator
2. Increase in central subfield thickness  $> 75 \mu\text{m}$  from baseline
3. Presence of vision-threatening hemorrhage due to AMD

\*Subjects received prophylaxis of 60 mg oral prednisone for 6 days starting at Day -3 followed by 7-day taper. \*\*Subjects receive prophylaxis of QID difluprednate eye drops for 3 weeks starting at Day 1 followed by a 3-week taper. BCVA, best-corrected visual acuity; ETDRS, Early Treatment Diabetic Retinopathy Study; IVT, intravitreal therapy; SD-OCT, spectral domain optical coherence tomography; NCT03748784

# OPTIC Patient Status



	<b>Cohort 1 (N=6)</b>	<b>Cohort 2 (N=6)</b>	<b>Cohort 3 (N=9)</b>	<b>Cohort 4 (N=9)</b>
<b>ADVM-022 Dose, vg/eye</b>	<b>High Dose</b> 6x10 <sup>11</sup>	<b>Low Dose</b> 2x10 <sup>11</sup>	<b>Low Dose</b> 2x10 <sup>11</sup>	<b>High Dose</b> 6x10 <sup>11</sup>
<b>Steroid Prophylaxis</b>	<b>Oral</b> 13-day course	<b>Oral</b> 13-day course	<b>Eye drops</b> 6-week course	<b>Eye drops</b> 6-week course
<b>Follow-Up, Weeks</b>	Completed (all with 104 weeks)	64–92 weeks (median 88)	48–72 weeks (median 68)	32–44 weeks (median 36)
<b>Baseline Characteristics</b>	✓	✓	✓	✓
<b>Safety Data</b>	✓	✓	✓	✓
<b>Efficacy Data†</b>	✓	✓	✓	✓
<b>Aqueous anti-VEGF Protein Expression Data</b>	✓	N/A	✓	✓

†Includes BCVA and CST outcomes and need for supplemental anti-VEGF injection

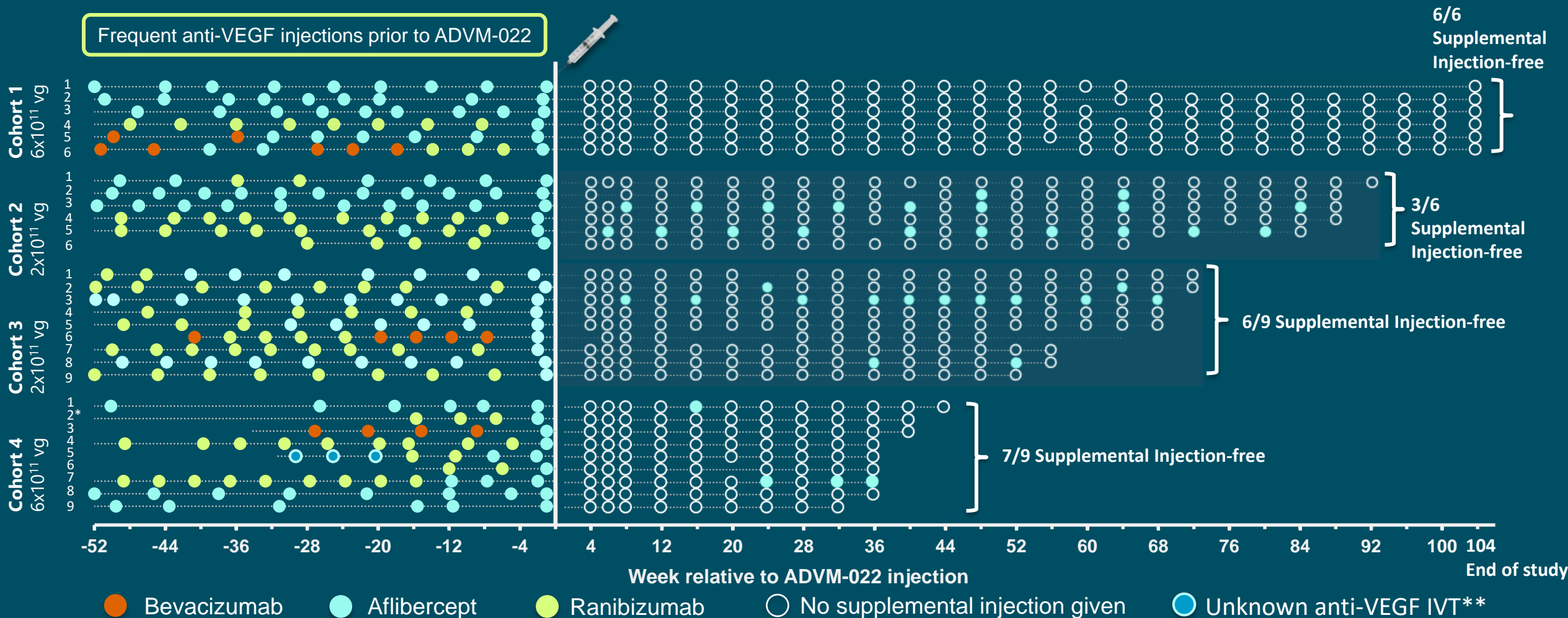
# Neovascular AMD Study Population Previously Required Frequent Injections to Maintain Vision



Baseline Characteristics	Cohort 1 6E11 (N=6)	Cohort 2 2E11 (N=6)	Cohort 3 2E11 (N=9)	Cohort 4 6E11 (N=9)
Mean (range) Age, Years	79.0 (62–88)	79.8 (74–90)	77.4 (65–90)	79.9 (68–88)
Mean (range) Years Since nAMD Diagnosis	4.5 (0.9–10.6)	4.1 (0.5–6.8)	3.3 (0.7–8.0)	3.2 (0.2–8.0)
Mean (range) Number anti-VEGF Injections Since Initial Diagnosis*	38.2 (7–109)	34.0 (4–69)	24.8 (9–70)	28.5 (2–58)**
Mean (range) Number anti-VEGF Injections in 12 Months Prior to ADVIM-022	9.2 (8–11)	9.2 (5–11)	9.1 (7–10)	7.1 (3–12)**
Mean (range) BCVA, ETDRS Letters Approximate Snellen Equivalent	65.8 (57–77) 20/50	64.7 (53–72) 20/50	65.9 (53–75) 20/50	65.0 (54–77) 20/50
Mean (range) CST, $\mu\text{m}$	369.2 (293–561)	307.7 (235–339)	473.4 (301–857)	398.6 (255–538)

\*Not including the mandated aflibercept at Screening; \*\*Excluding Patient #2 with incomplete prior anti-VEGF data.  
 BCVA, best corrected visual acuity; CST, central subfield thickness; ETDRS, Early Treatment Diabetic Retinopathy Study  
 nAMD, neovascular age-related macular degeneration; VEGF, vascular endothelial growth factor

# Majority of Patients are Supplemental Injection Free after a Single IVT Injection of ADVM-022 in OPTIC



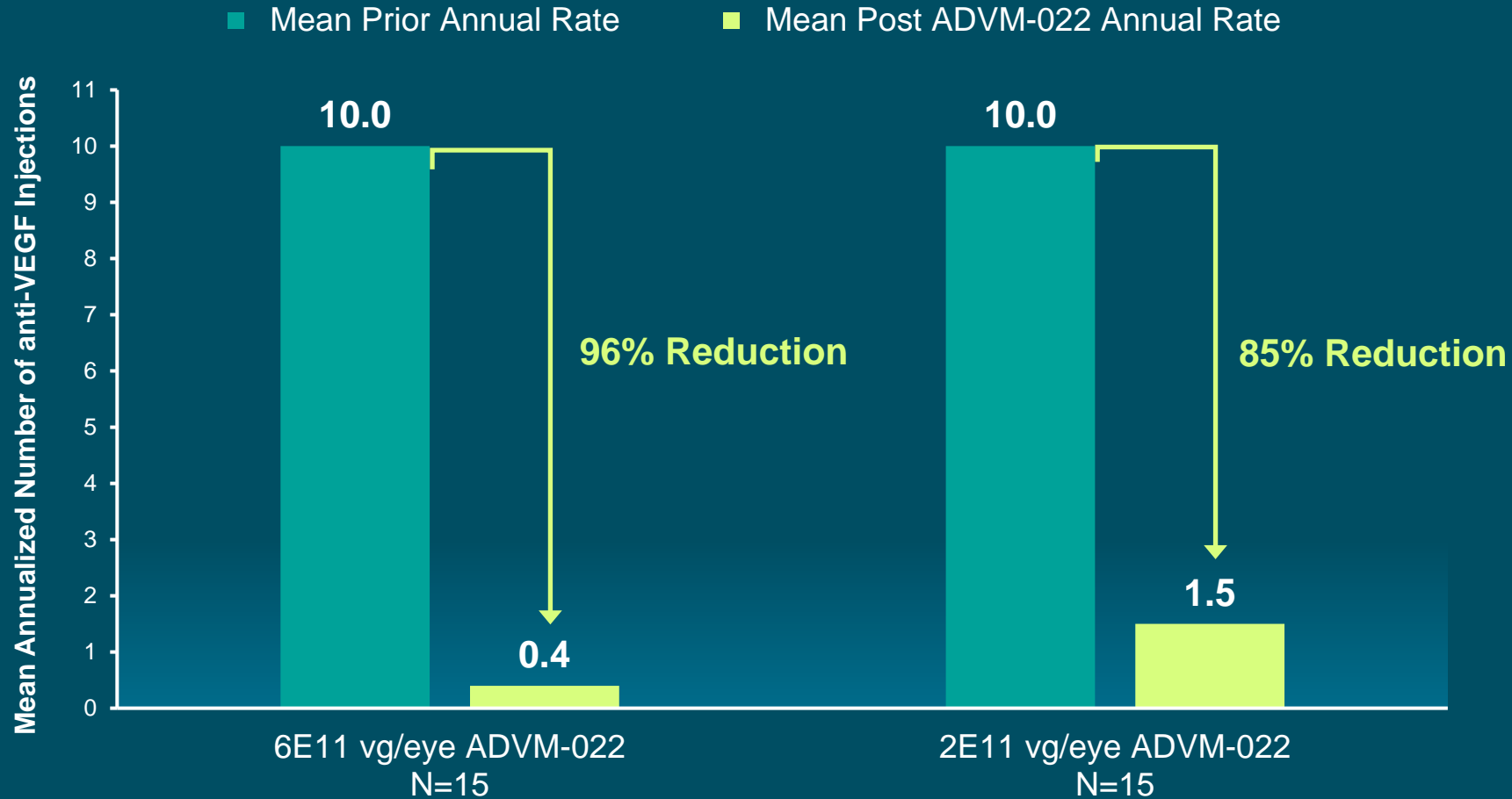
Five patients were diagnosed <1 year prior to ADVM-022 injection: one each in Cohorts 2 and 3, three in Cohort 4.

Cohort 2, Patient 6 death due to lung malignancy; \*Incomplete prior data for Cohort 4, Patient 2.

\*\*Received in a clinical trial not yet unmasked (NCT03790852).

Cohort 4, Patient 4 had a port delivery system (PDS) implanted 3 years prior to Screening (explanted 1.5 years later).

# 85%-96% Reduction in Annualized anti-VEGF Injection Following ADVM-022



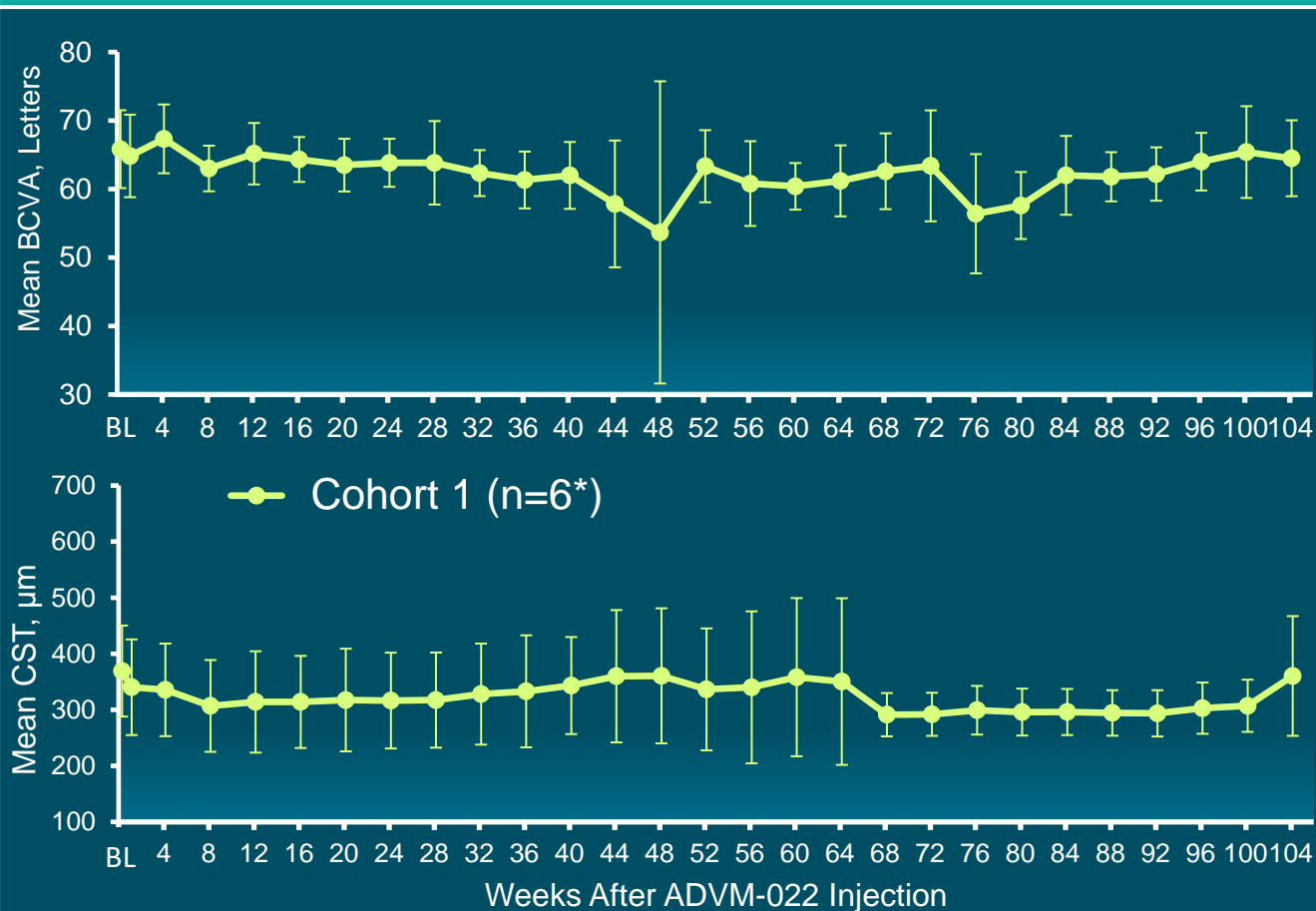
Annualized rate (Prior) = (number of IVTs in 12 months prior to ADVM-022) / (days from the first IVT in the past 12 months to ADVM-022 / 365.25).

Annualized rate (Post) = (numbers of aflibercept IVTs since ADVM-022) / (days from ADVM-022 to the last study follow-up / 365.25).

Data cut: March 10, 2021

# Cohort 1 [6E11]: BCVA and CST Stable, Zero Supplemental Injections

### Mean (90% CI) by Visit Through Week 104

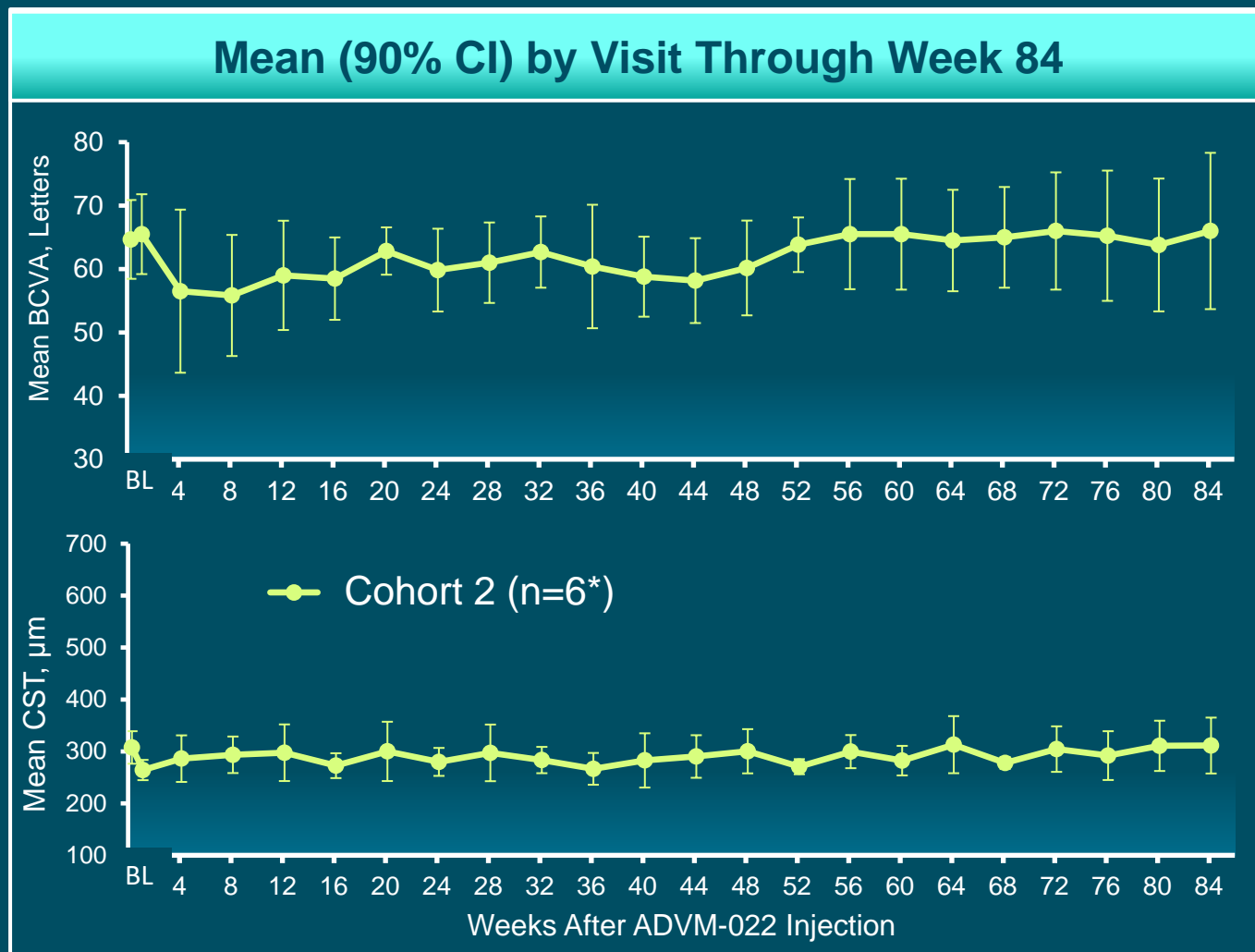


### Latest Outcomes at Week 104

<b>Follow-Up</b>	All with 104 weeks (median 104)
<b>Supplemental-Free Patients</b>	100% (6/6)
<b>Mean BCVA Change from Baseline</b>	
<b>All Patients</b>	-1.3 Letters
<b>Mean CST Change from Baseline</b>	
<b>All Patients</b>	-8.7 µm

\*One patient had low BCVA and no CST values at 44 and 48 weeks due to retinal detachment; n=5 from Week 56 to 100  
 Aflibercept 2 mg IVT administered at baseline, 7–15 days prior to ADVM-022 IVT (Day 1);  
 BCVA, best corrected visual acuity; CST, central subfield thickness; BL, baseline  
 Error bars are 90% CIs of the mean absolute BCVA and CST using T-distribution

# Cohort 2 [2E11]: BCVA and CST Maintained Over Time



Latest Outcomes (as of 3/10/2021)	
<b>Follow-Up</b>	64**–92 weeks (median 88)
<b>Supplemental-Free Patients</b>	50% (3/6)
<b>Mean BCVA Change from Baseline</b>	
<b>All Patients</b>	–1.5 Letters
<b>Supplemental-Free Patients</b>	–1.0 Letters
<b>Mean CST Change from Baseline</b>	
<b>All Patients</b>	–28.2 µm
<b>Supplemental-Free Patients</b>	–30.3 µm

\*n=5 for Week 36, 40, 68 to 84 visits (n=4 at Week 76).

\*\*A patient missed visits after Week 64 due to worsening of COPD and died of lung malignancy at ~76 weeks.

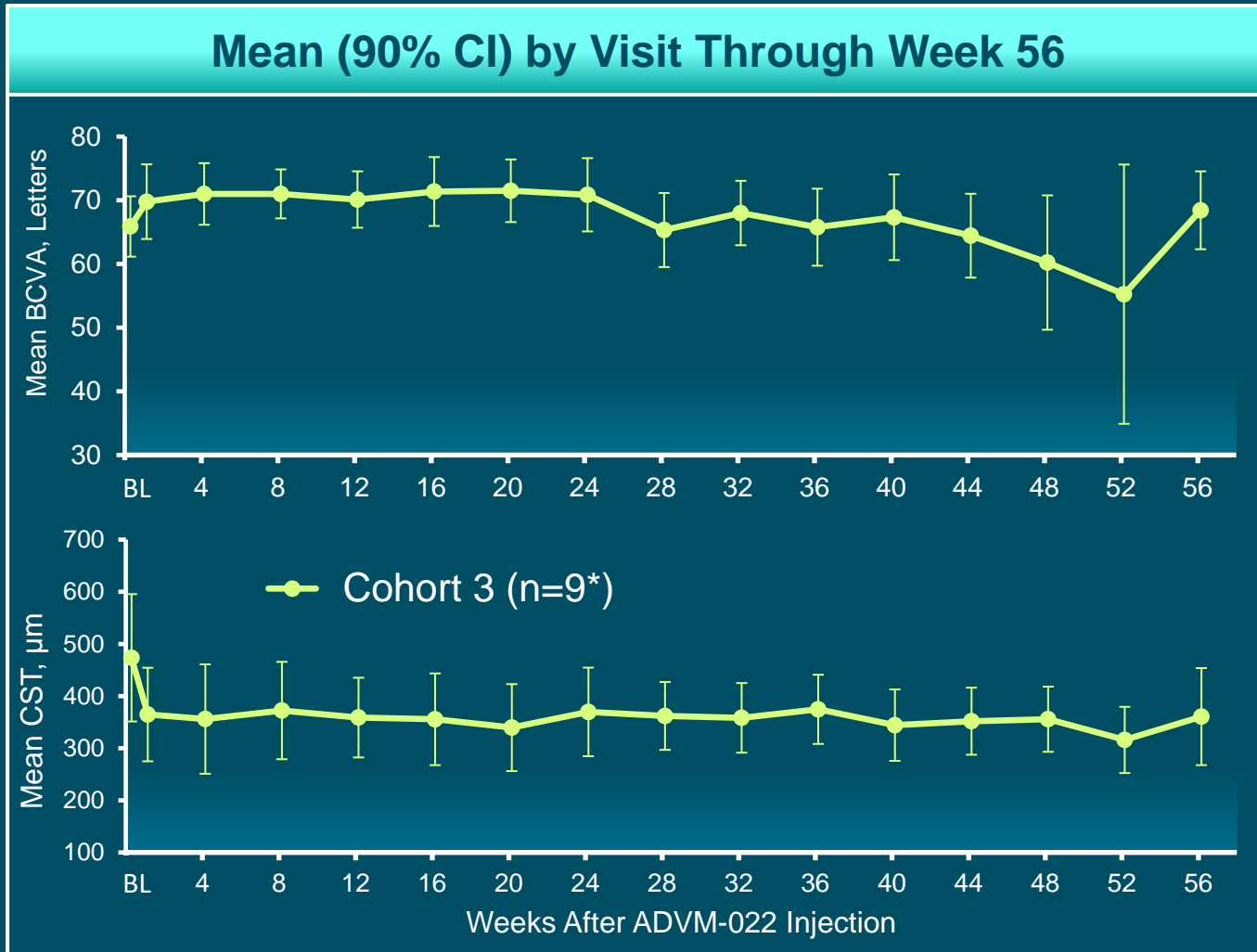
Aflibercept 2 mg IVT administered at baseline, 7–15 days prior to ADVM-022 IVT (Day 1).

BCVA, best corrected visual acuity; CST, central subfield thickness; BL, baseline

Error bars are 90% CIs of the mean absolute BCVA and CST using T-distribution



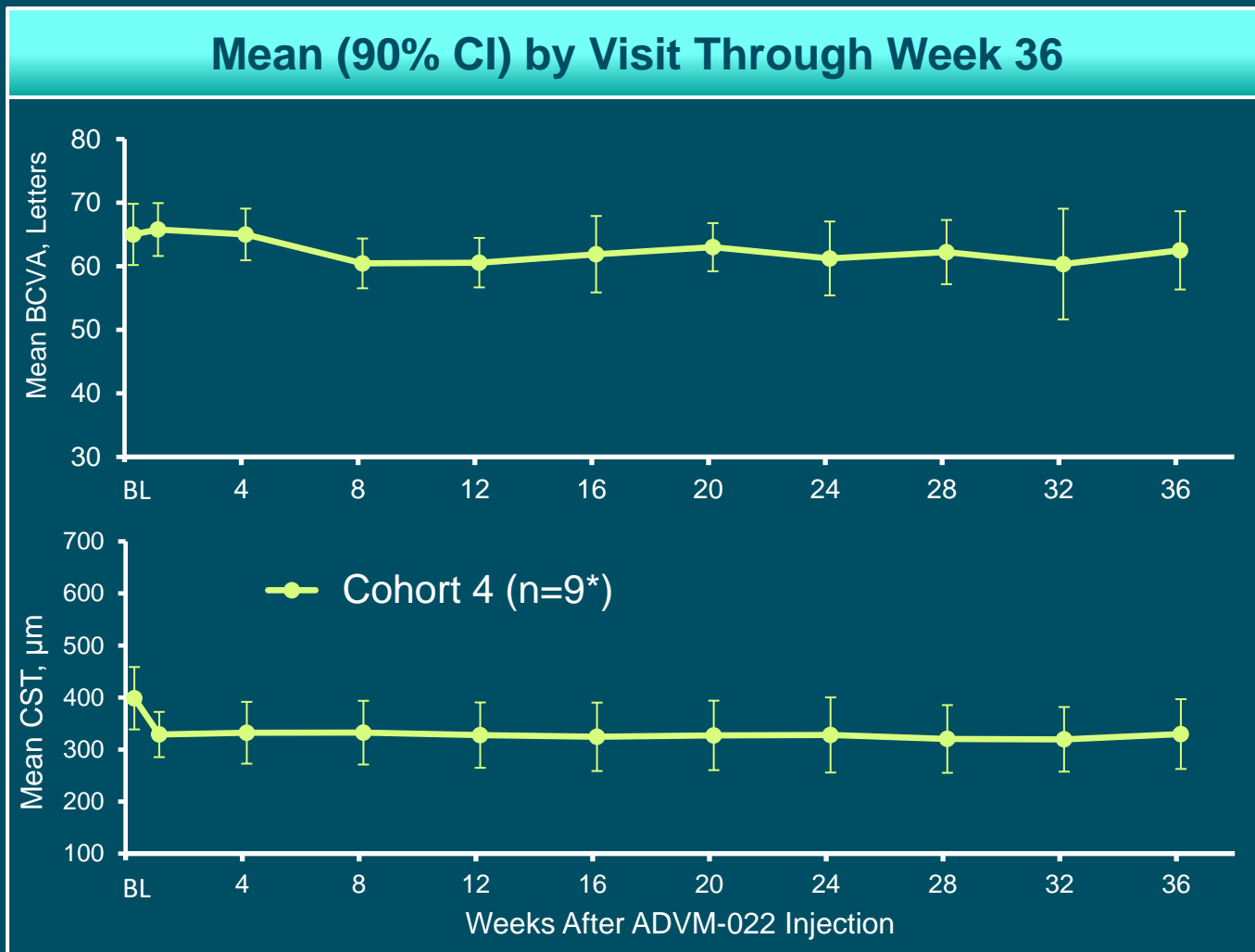
# Cohort 3 [2E11]: BCVA Maintained and CST Improved



Latest Outcomes (as of 3/10/2021)	
<b>Follow-Up</b>	48–72 weeks (median 68)
<b>Supplemental-Free Patients</b>	67% (6/9)
Mean BCVA Change from Baseline	
<b>All Patients</b>	+1.4 Letters
<b>Supplemental-Free Patients</b>	+4.3 Letters
Mean CST Change from Baseline	
<b>All Patients</b>	–134.4 µm
<b>Supplemental-Free Patients</b>	–181.7 µm

\*n=8 for Week 4, 16 and 20; n=7 at Week 24; n=8 (BCVA) and 5 (CST) at Week 52; n=7 (BCVA) and 6 (CST) at Week 56.  
 Aflibercept 2 mg IVT administered at baseline, 7–15 days prior to ADVM-022 IVT (Day 1)  
 BCVA, best corrected visual acuity; CST, central subfield thickness; BL, baseline  
 Error bars are 90% CIs of the mean absolute BCVA and CST using T-distribution

# Cohort 4 [6E11]: BCVA and CST Maintained Over Time



### Latest Outcomes (as of 3/10/2021)

<b>Follow-Up</b>	32–44 weeks (median 36)
<b>Supplemental-Free Patients</b>	78% (7/9)
<b>Mean BCVA Change from Baseline</b>	
<b>All Patients</b>	–0.2 Letters
<b>Supplemental-Free Patients</b>	–0.4 Letters
<b>Mean CST Change from Baseline</b>	
<b>All Patients</b>	–77.1 µm
<b>Supplemental-Free Patients</b>	–77.3 µm

\*n=8 at Weeks 20 and 36

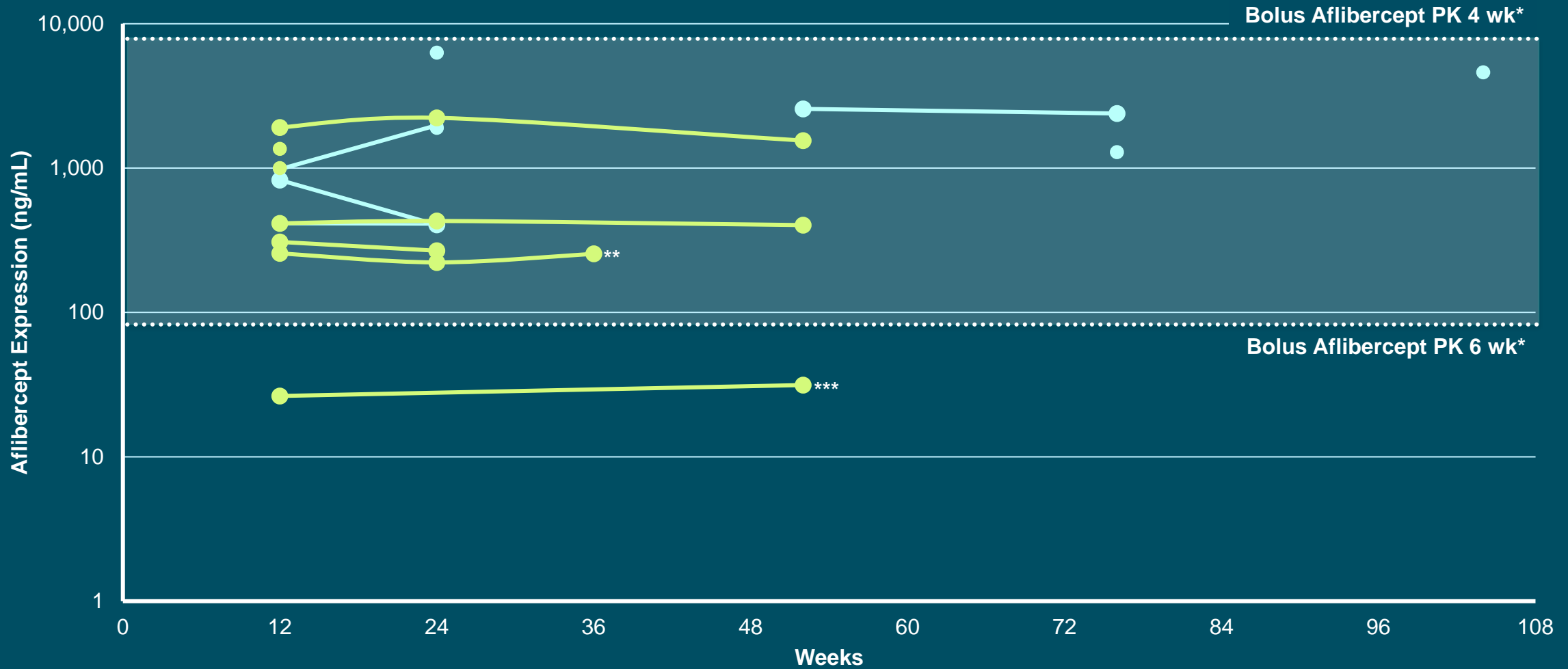
Aflibercept 2 mg IVT administered at baseline, 7–15 days prior to ADVM-022 IVT (Day 1)

BCVA, best corrected visual acuity; CST, central subfield thickness; BL, baseline

Error bars are 90% CIs of the mean absolute BCVA and CST using T-distribution

# Robust Aflibercept Expression Levels Observed for Both Doses

*Within modeled therapeutic range, reaching top of dose response curve*



\*Modeled based on Do et al. Retina 2020; 40:643-647.

\*\* Patient rescued at Week 36

\*\*\* Patient rescued at Week 24. Sample collected 28 weeks after supplemental injection.

Protocol amendment for aqueous sample collection for patients that consented. No samples available from Cohort 2.

To isolate the effect of ADVM-022, samples that were collected within 2 months of supplemental aflibercept are not shown.

— 6x10<sup>11</sup> vg/eye Dose    — 2x10<sup>11</sup> vg/eye Dose

# Safety Summary Across Cohorts in OPTIC



- No ADVIM-022-related non-ocular adverse events
  - A patient (Cohort 2) died of lung malignancy ~76 weeks
- Inflammation when observed is mild and responsive to steroid eye drops
  - Immune response occurs early and is well controlled with steroid eye drops
  - Ocular inflammation is minimal at  $2 \times 10^{11}$  vg/eye dose and is responsive to steroid eye drops
- No clinical or fluorescein\* evidence of posterior inflammation
  - No vasculitis, retinitis, choroiditis, vascular occlusions or endophthalmitis
- All ADVIM-022-related ocular AEs were mild (80%) to moderate (20%)
  - One AE of special interest of moderate recurrent uveitis deemed to be related to ADVIM-022 was responsive to steroid eye drops (Cohort 1)
- One unrelated ocular SAE of retinal detachment surgically repaired and resolved (Cohort 1)
- Two patients had mild AEs of IOP elevation that resolved
  - One patient had two mild IOP elevations (highest 24 mmHg) that were both treated with Combigan® eye drops
  - One case in a patient on Combigan® for ocular hypertension at baseline which resolved with no change to treatment

\*Fluorescein angiography of posterior pole  
IOP, intraocular pressure; AEs, adverse events; SAEs, serious AEs

# Adverse Events Across Cohorts in OPTIC

ADVM-022 related events were mild (80%) or moderate (20%)



Adverse Events		Cohort 1 (N=6)		Cohort 2 (N=6)		Cohort 3 (N=9)		Cohort 4 (N=9)	
		Subjects	Events	Subjects	Events	Subjects	Events	Subjects	Events
Ocular	Serious	2	2*	0	0	0	0	0	0
	ADVM-022 Related**	6	32	5	21	5	15	8	32
	Total Ocular	6	57	6	37	8	37	8	43
Non-Ocular†	Serious ‡	1	1	2	5	2	2	0	0
	Total Non-Ocular†	5	20	6	14	6	12	3	4

\*Retinal detachment (unrelated to ADVM-022) and recurrent moderate uveitis (likely related to ADVM-022)

\*\* ADVM-022 related ocular events were mild (80%) or moderate (20%)

†None of the non-ocular AEs were ADVM-022 related

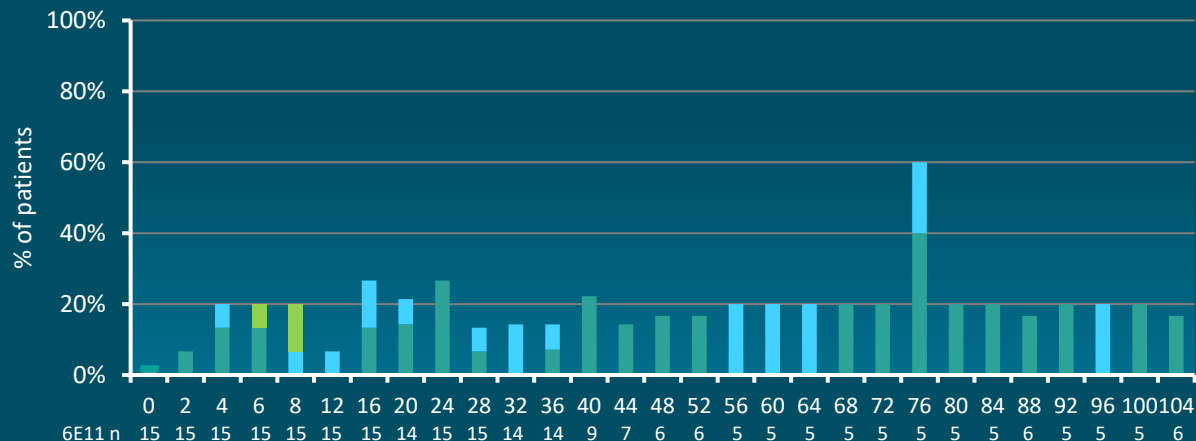
‡Serious non-ocular AEs included lumbar spinal stenosis (1) in Cohort 1; COPD (1), pneumonia (1, fatal), lung neoplasm malignant (1), pneumothorax (1), and hypertensive emergency (1) in Cohort 2; and COPD exacerbation (1), and stable angina pectoris (1) in Cohort 3

# Lower Immune Response with $2 \times 10^{11}$ vg/eye dose

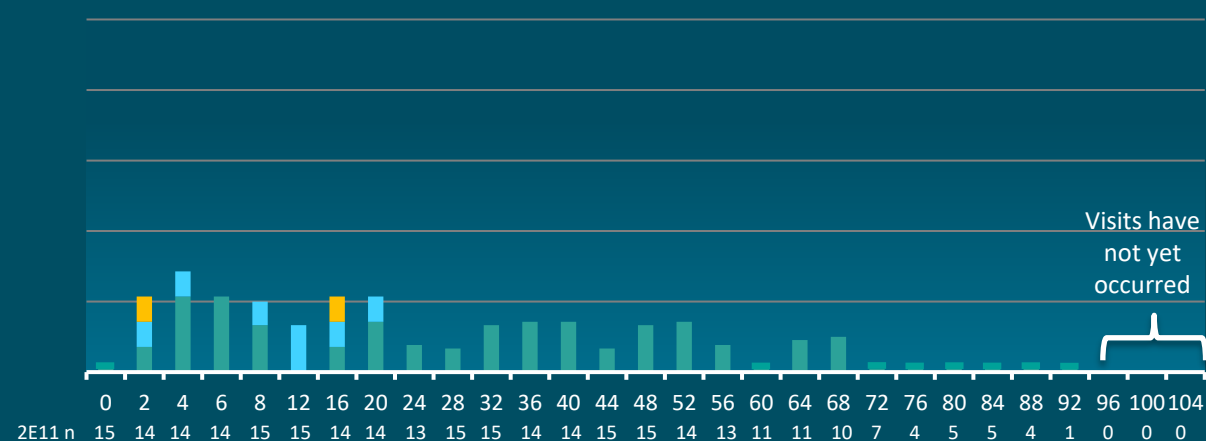
*Frequency and severity of inflammation decreases over time*

Cell Grades 0.5+ 1+ 2+ 3+ 4+

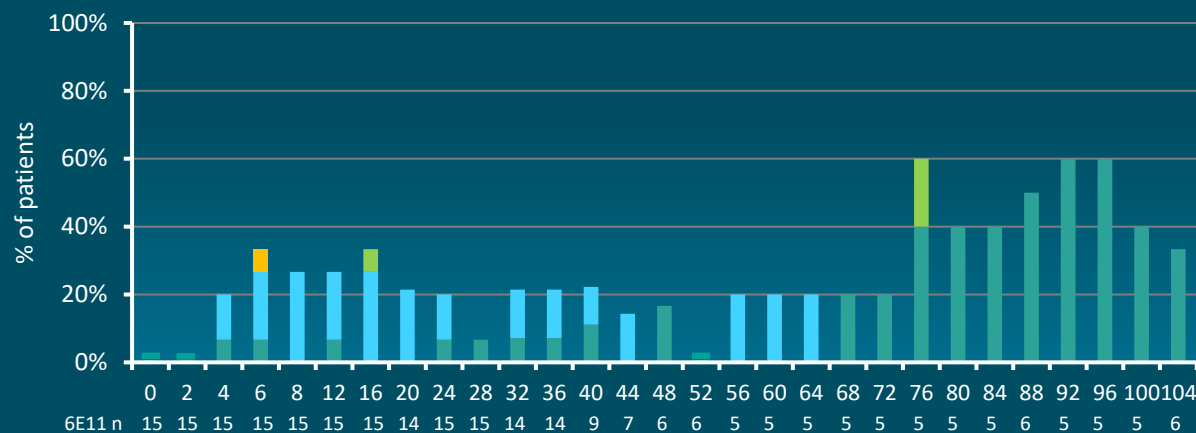
**AC Cells ( $6 \times 10^{11}$  vg/eye); Cohort 1 & 4**



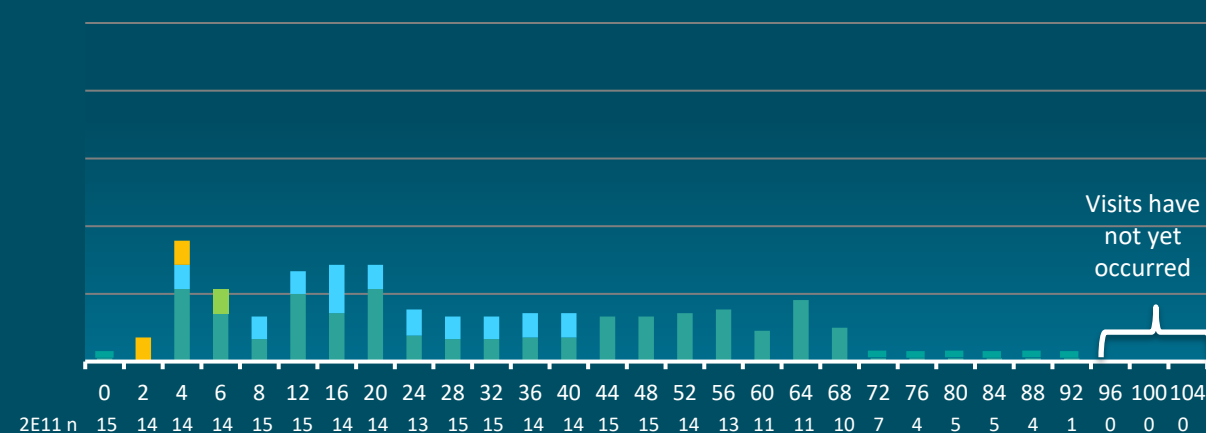
**AC Cells ( $2 \times 10^{11}$  vg/eye); Cohort 2 & 3**



**VC Cells ( $6 \times 10^{11}$  vg/eye); Cohort 1 & 4**



**VC Cells ( $2 \times 10^{11}$  vg/eye); Cohort 2 & 3**



Cell grades as assessed by slit lamp

Grade categories are based on the Standardization of Uveitis Nomenclature (SUN) criteria for aqueous cells and National Institutes of Health (NIH) guidelines for vitreous cells.

Aqueous cells (AC): 0.5+: 1-5 cells 1+: 6-15 cells 2+: 16-25 cells 3+: 26-50 cells 4+: >50 cells

Vitreous cells (VC): 0.5+: 1-10 cells 1+: 11-20 cells 2+: 21-30 cells 3+: 31-100 cells 4+: >100 cells; Rare cells are captured as 0.5+ for this analysis

Data cut: March 10, 2021

# AC – Inflammation was Mild and Decreasing Over Time in Cohort 3 [2x10<sup>11</sup> vg/eye dose, 6-week steroid drops prophylaxis]

		Week																			
		0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	
Patients	C3-1	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	
	C3-2	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0	
	C3-3*	0	0.5	0	1	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5*	0	0.5	0.5		
	C3-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	C3-5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	C3-6	0	-	0	0	-	-	-	0	0	0	0	0	0	0	-	-	-	-		
	C3-7**	0	0	0.5	0	0.5	0	0	0	0	0	0	0	0	0	0**					
	C3-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	C3-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

\*Cataract surgery before Week 56

\*\*Cataract surgery before Week 56

AC Grade    0    0.5+    1+    2+    3+    4+

Cell grades as assessed by slit lamp

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Vitreous cells (VC): 0.5+: 1-10 cells 1+: 11-20 cells 2+: 21-30 cells 3+: 31-100 cells 4+: >100 cells; Rare cells are captured as 0.5+ for this analysis



# VC – Inflammation was Mild and Decreasing Over Time in Cohort 3 [2x10<sup>11</sup> vg/eye dose, 6-week steroid drops prophylaxis]

		Week																			
		0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	
Patients	C3-1	0	0.5	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	
	C3-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C3-3*	0	0.5	0	0.5	0.5	0.5	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5*	0	0.5	0.5		
	C3-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	C3-5	0	1	0.5	0.5	0.5	0.5	0.5	0	0	0	0	0	0	0	0	0	0	0		
	C3-6	0	-	0	0	-	-	-	0	0	0	0	0	0	0	-	-	-	-		
	C3-7**	0	0	0	0	1	0.5	0	0	0	0	0	0	0	0	0**					
	C3-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	C3-9	0	0	0	0	0	0	0	0	0	0	0	0	0	0						

\*Cataract surgery before Week 56

\*\*Cataract surgery before Week 56

VC Grade      0      0.5+      1+      2+      3+      4+

Cell grades as assessed by slit lamp

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Data cut: March 10, 2021

# Steroid Eye Drops Post Prophylaxis Decrease Over Time in Cohort 3 $[2 \times 10^{11}$ vg/eye dose, 6-week steroid drops prophylaxis]

		6-week prophylaxis steroid eye drops																			
		Week																			
		0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	
Patients	C3-1	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C3-2	4	2	0	0	0	0	0	0	2	3	3	3	0	0	0	0	0	0	0	
	C3-3*	4	3	2	4	2	4	4	4	4	4	4	4	4	4	4*	3	3	2		
	C3-4	4	2	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	
	C3-5	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C3-6	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C3-7**	4	2	2	1	4	4	3	3	1	1	1	0.5	0.5	0.5	1**					
	C3-8	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	C3-9	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

\*Cataract surgery before Week 56

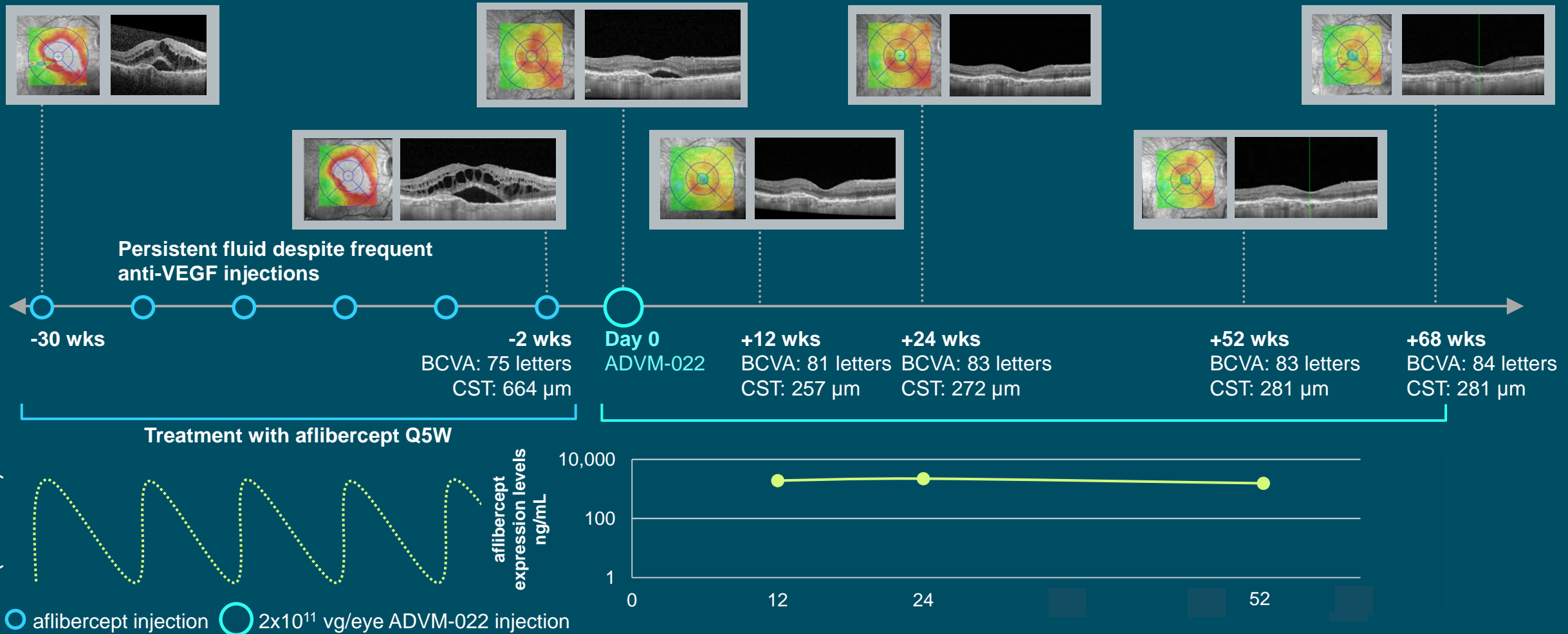
\*\*Cataract surgery before Week 56

0.5 represents drops every other day



# Rapid and Sustained Improvements to Ocular Anatomy and Vision after Single IVT Injection of ADVM-022 [2E11]

Patient Case from Cohort 3 [2E11]: 82-year-old male with 19 IVTs prior to study with 9 IVTs in the last 12 months



# Key Learnings from OPTIC Study in neovascular AMD

- ADVM-022 provides durable, sustained efficacy observed with both doses ( $2 \times 10^{11}$  vg/eye,  $6 \times 10^{11}$  vg/eye)
  - Patients maintained or gained vision (BCVA), stable to improved retinal anatomy (CST)
  - Aflibercept protein expression within targeted therapeutic range and stable out to 104 weeks
  - 85%-96% reduction in annualized injection frequency
- Well-tolerated safety profile
  - Lower ADVM-022-related ocular adverse events at  $2 \times 10^{11}$  vg/eye dose
  - Post prophylaxis inflammation at  $2 \times 10^{11}$  vg/eye dose is minimal and occurs in few patients
- Cohort 3 provides insights to efficacy and safety at the lower dose [ $2 \times 10^{11}$  vg/eye]
  - Efficacy (BCVA, CST), reduction in annualized injection frequency and aflibercept protein expression similar to  $6 \times 10^{11}$  vg/eye dose
  - Majority of patients did not require more than 6 weeks of prophylactic steroid eye drops
- Further studies are warranted

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Thank you

