Slide 15 Corrected on October 28, 2019

Biogen®

Aducanumab Update

October 22, 2019

Forward-looking statements

This presentation contains forward-looking statements, including statements made pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995, about additional results from the Phase 3 clinical studies of aducanumab; the potential clinical effects of aducanumab; the potential benefits, safety, and efficacy of aducanumab; potential regulatory discussions, submissions, and approvals and the timing thereof; clinical development programs, clinical trials, data readouts, and presentations related to aducanumab; the enrollment of any future clinical studies of aducanumab; the treatment of Alzheimer's disease; the potential of Biogen's commercial business and pipeline programs, including aducanumab; the anticipated benefits and potential of Biogen's collaboration arrangements with Eisai; and risks and uncertainties associated with drug development and commercialization. These forward-looking statements may be accompanied by such words as "aim," "anticipate," "believe," "could," "estimate," "expect," "forecast," "intend," "may," "plan," "potential," "possible," "will," "would," and other words and terms of similar meaning. Drug development and commercialization involve a high degree of risk, and only a small number of research and development programs result in commercialization of a product. Results in early stage clinical trials may not be indicative of full results or results from later stage or larger scale clinical trials and do not ensure regulatory approval. You should not place undue reliance on these statements or the scientific data presented.

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These statements are based on Biogen's current beliefs and expectations and speak only as of the date of this presentation. Biogen does not undertake any obligation to publicly update any forward-looking statements.

Aducanumab summary

1. Following discussions with the FDA, Biogen plans to submit a regulatory filing in early 2020
2. The futility analysis in March 2019 was based on a smaller, earlier dataset with less exposure to high dose aducanumab. The result of the futility analysis was incorrect.
3. New analysis of larger dataset showed that aducanumab reduced clinical decline in patients with early Alzheimer's disease as measured by the pre-specified primary and secondary endpoints
4. The positive results of this new analysis were driven primarily by greater exposure to high dose aducanumab in the larger dataset
5. If approved, aducanumab would become the first therapy to reduce clinical decline in Alzheimer's disease

3 steps from futility to today

1. Futility analysis based on earlier and smaller dataset

- EMERGE and ENGAGE discontinued following a **pre-specified futility analysis**
- The **futility analysis was based on data available as of December 26, 2018, from patients who had the opportunity to complete 18-month study period** and predicted that the studies were unlikely to meet their primary endpoints upon completion

2. Additional data become available; Biogen consulted external advisors and FDA

- Following the discontinuation of the studies, **additional data from these studies became available**
- **A new analysis of this larger dataset** suggested a different possible outcome than that predicted by the futility analysis
- **Biogen consulted with external advisors and the FDA** to better understand these different results and their potential implications

3. EMERGE is positive, ENGAGE believed to be supportive; plan to file

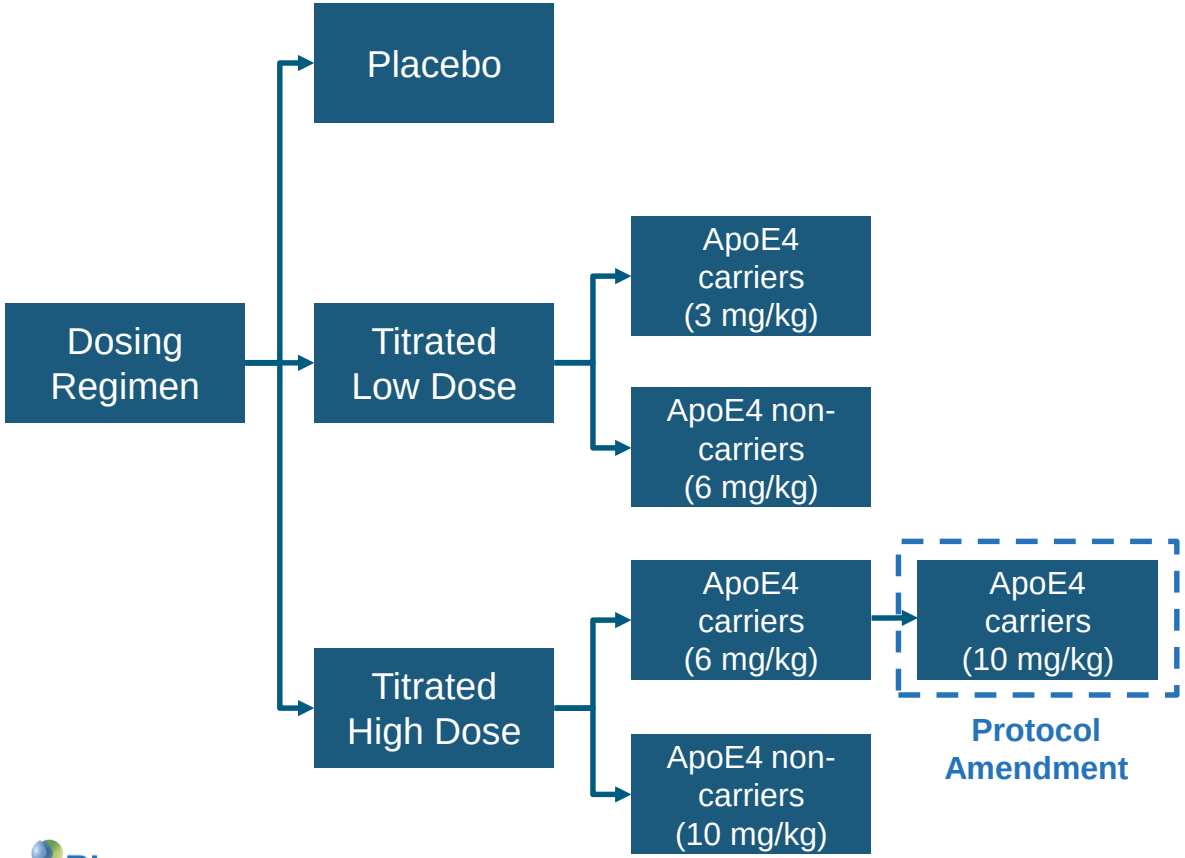
- Biogen believes that the difference between the results of the new analysis of the larger dataset and the outcome predicted by the futility analysis was driven primarily by **patients' greater exposure to high dose aducanumab**

Phase 3 aducanumab data

Sufficient exposure to high dose aducanumab reduced clinical decline across multiple clinical endpoints

- This reduction in clinical decline was **statistically significant in EMERGE**
- Biogen believes data from patients who achieved **sufficient exposure to high dose aducanumab in ENGAGE support the findings of EMERGE**
- After consultation with the FDA, we believe that the **totality of these data support a regulatory filing**
- Patients included in the **futility analysis** had enrolled early in the studies and **had lower average exposure to aducanumab**
- **Two protocol amendments** were put in place to enable **more patients to reach high dose** and for a longer duration
- Differences between EMERGE and ENGAGE can mostly be accounted for by **greater exposure to high dose in EMERGE**

EMERGE and ENGAGE dosing regimens

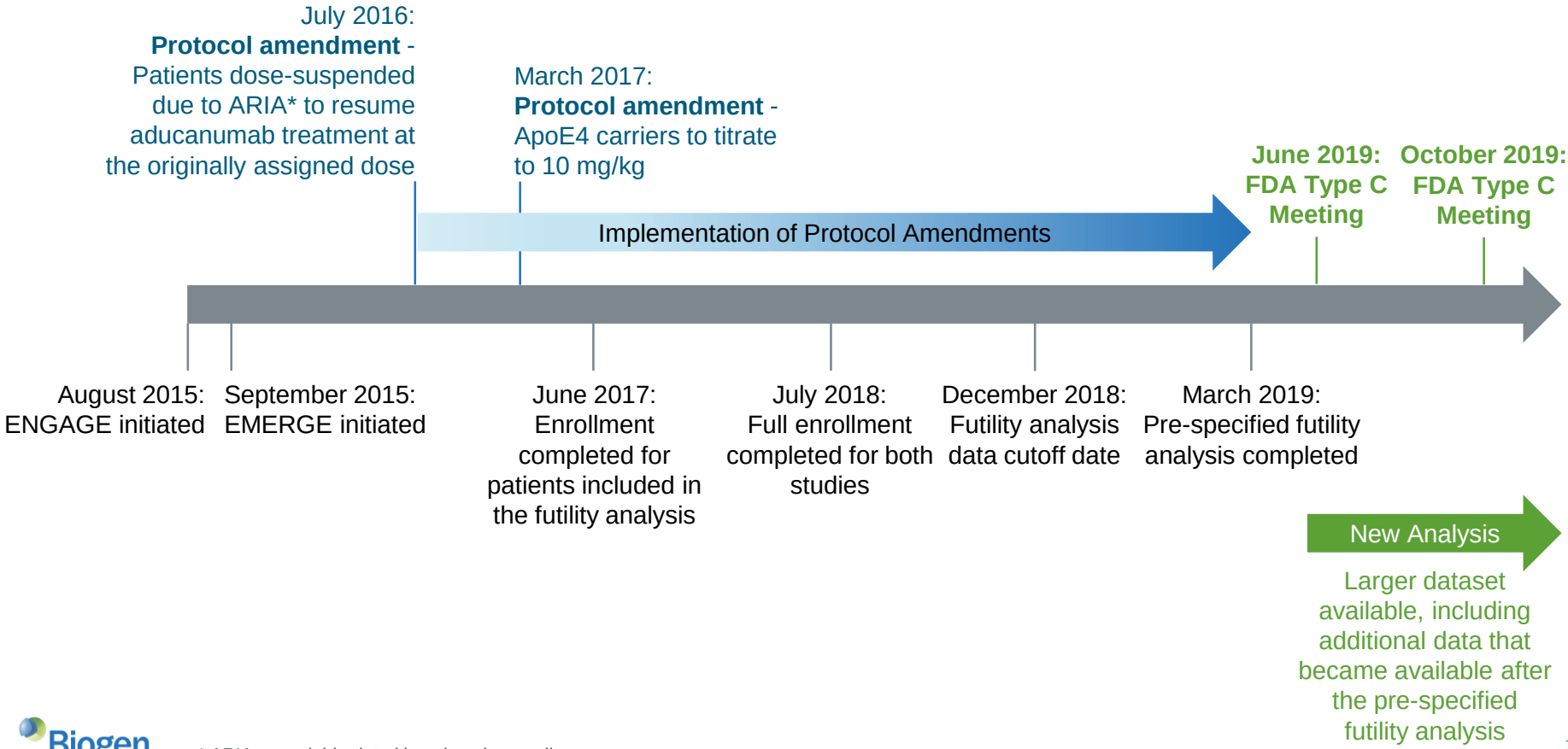


EMERGE/ENGAGE Overview

- Two identically designed Phase 3 studies
- Enrolled patients with mild cognitive impairment due to Alzheimer's disease (AD) and mild AD dementia
- All patients screened with PET* for elevated brain amyloid beta levels
- ~ 2/3 of patients were ApoE4 carriers in each study, well balanced across arms
- Primary endpoint: CDR-SB# at 18 months
- All treatment arms included titration

* PET = positron emission tomography
# CDR-SB = Clinical Dementia Rating-Sum of Boxes

EMERGE and ENGAGE timeline



* ARIA = amyloid-related imaging abnormality

Pre-specified futility analysis

Futility Analysis Details

- **Conditional power** = probability that primary efficacy endpoint analysis would be statistically significant in favor of aducanumab at the planned final analysis
- **Prespecified criteria** = both dose arms of both studies having less than 20% conditional power to meet the primary endpoint at the final analysis
  - Criteria met in both arms of both studies
- Pre-specified methodology (a well-accepted approach): Given **identical study design**, conditional power would be calculated using **pooled data** from both studies to predict the future behavior of the remaining patients
  - Pooling was **believed to be a more powerful statistical methodology**, assuming no large heterogeneity between the studies
- At the time of the futility analysis, **EMERGE was trending positive, while ENGAGE was not**
- **We did not understand the drivers of these different results**
  - We did know that the **protocol amendments** could have had differential effects on the two studies due to the relative timing of enrollment, but we **did not anticipate the magnitude of the effect** this would have on the data

Outline of available datasets

Dataset	Subject Population	EMERGE n (%)	ENGAGE n (%)
Futility	Opportunity to Complete (OTC)[a]	803 (49%)	945 (57%)
Larger Dataset	Opportunity to Complete (OTC)[b]	982 (60%)	1,084 (66%)
	Intent to Treat (ITT)[c]	1,638 (100%)	1,647 (100%)
	Amyloid beta PET sub-study	485 (30%)	582 (35%)

[a] Subjects who have had the opportunity to complete week 78 visit by December 26, 2018.
[b] Subjects who have had the opportunity to complete week 78 visit by March 20, 2019.
[c] All subjects' data (data after March 20, 2019, are censored for efficacy analyses).

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Primary endpoint of EMERGE (larger dataset)

	ITT Population		OTC Population	
	% Reduction vs. Placebo[a] p-value		% Reduction vs. Placebo[a] p-value	
	Low dose (N=543)	High dose (N=547)	Low dose (N=329)	High dose (N=340)
CDR-SB	**-14%** 0.117	**-23%** 0.010	**-16%** 0.134	**-23%** 0.031

[a]: difference in change from baseline vs. placebo at Week 78. Negative percentage means less decline in the treated arm.

N: numbers of randomized and dosed subjects that were included in the analysis. Placebo = 548 (ITT) and 313 (OTC).

Secondary endpoints of EMERGE (larger dataset)

	ITT Population		OTC Population	
	% Reduction vs. Placebo[a] p-value		% Reduction vs. Placebo[a] p-value	
	Low dose (N=543)	High dose (N=547)	Low dose (N=329)	High dose (N=340)
MMSE	**3%** 0.690	**-15%** 0.062	**3%** 0.872	**-23%** 0.032
ADAS-Cog13	**-14%** 0.167	**-27%** 0.010	**-10%** 0.410	**-25%** 0.038
ADCS-ADL-MCI	**-16%** 0.156	**-40%** 0.001	**-20%** 0.117	**-46%** 0.0002

[a]: difference in change from baseline vs. placebo at Week 78. Negative percentage means less decline in the treated arm.

N: numbers of all randomized and dosed subjects that were included in the analysis. Placebo = 548 (ITT) and 313 (OTC).

MMSE = Mini-Mental State Examination; ADAS-Cog13 = AD Assessment Scale-Cognitive Subscale 13 Items; ADCS-ADL-MCI = AD Cooperative Study-Activities of Daily Living Inventory Mild Cognitive Impairment Version

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Primary and secondary endpoints from ENGAGE (larger dataset)

	ITT Population		OTC Population	
	% Reduction vs. Placebo[a] p-value		% Reduction vs. Placebo[a] p-value	
	Low dose (N=547)	High dose (N=555)	Low dose (N=370)	High dose (N=345)
CDR-SB	**-12%** 0.236	**2%** 0.825	**-8%** 0.489	**6%** 0.627
MMSE	**-6%** 0.488	**3%** 0.796	**-3%** 0.741	**13%** 0.237
ADAS-Cog13	**-11%** 0.248	**-12%** 0.245	**-1%** 0.950	**-2%** 0.874
ADCS-ADL-MCI	**-18%** 0.135	**-18%** 0.152	**-12%** 0.434	**-12%** 0.405

[a]: difference in change from baseline vs. placebo at Week 78. Negative percentage means less decline in the treated arm.

N: numbers of all randomized and dosed subjects that were included in the analysis. Placebo = 545 (ITT) and 369 (OTC).

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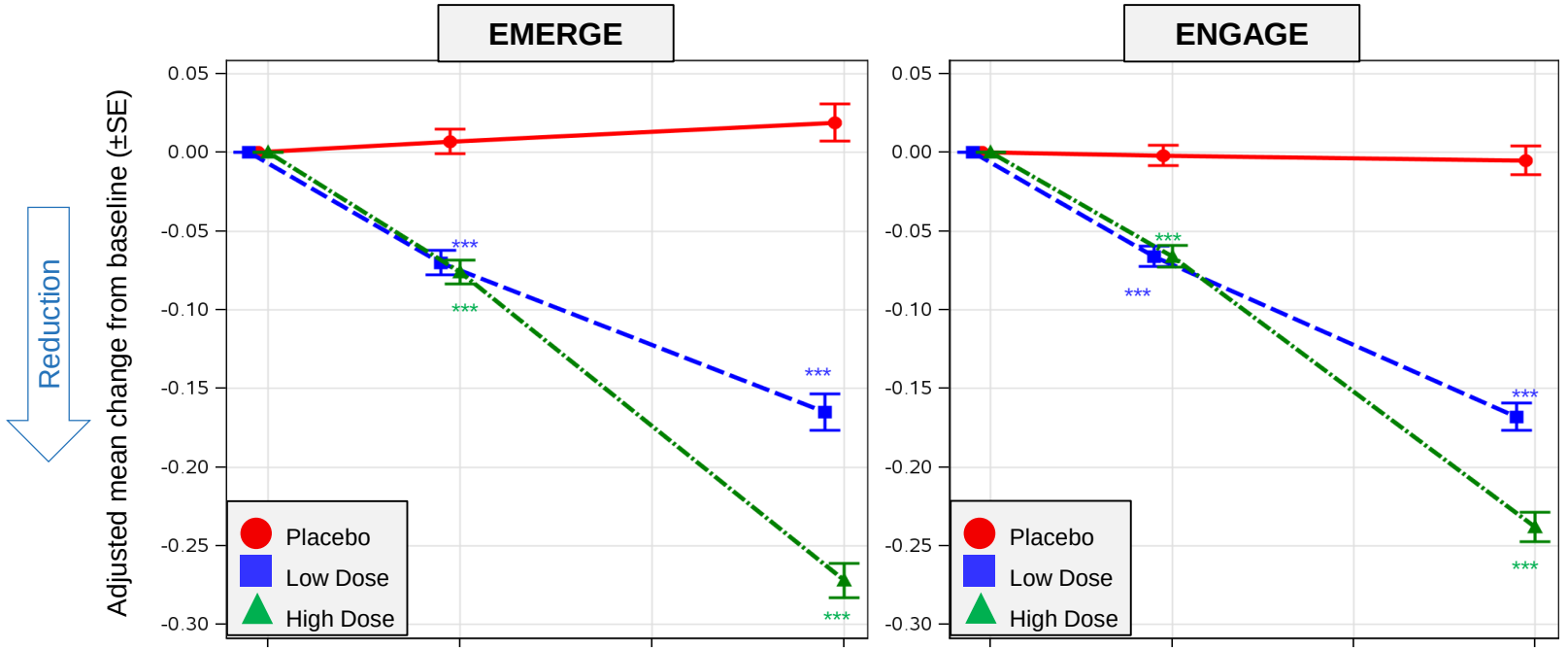
Amyloid PET SUVR: Longitudinal change from baseline

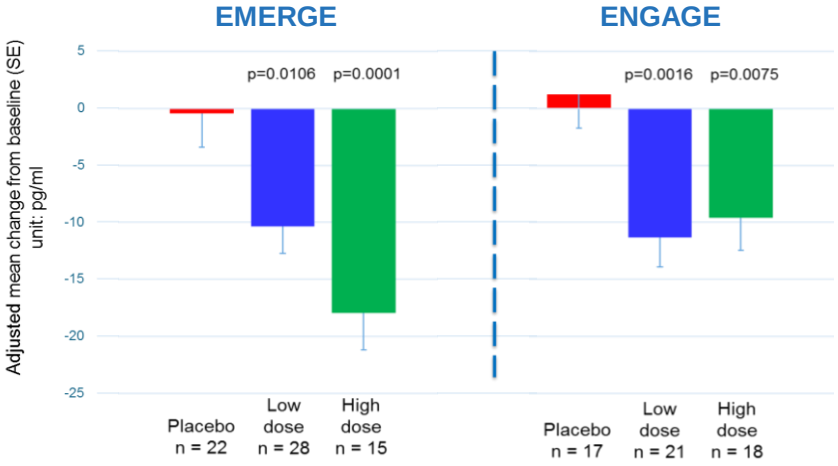


	EMERGE			ENGAGE		
	Baseline	Week 26	Week 78	Baseline	Week 26	Week 78
Placebo	157	128	74	203	164	104
Low Dose	157	125	79	198	166	116
High Dose	171	136	87	181	149	97

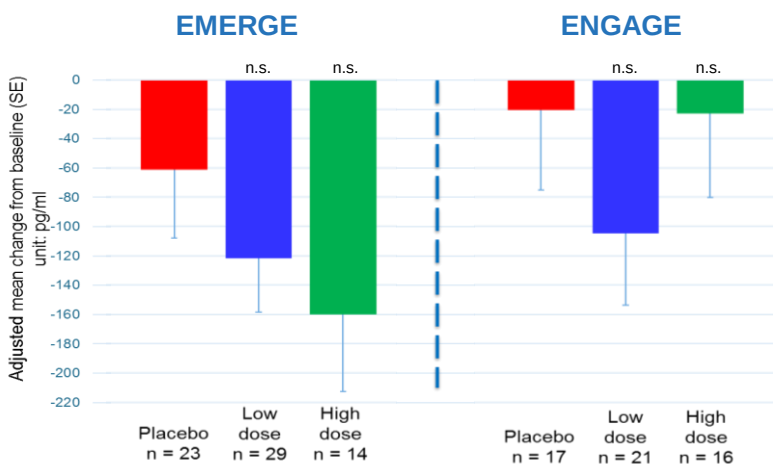
Nominal p values: ***P<0.001 vs. placebo.

CSF biomarkers of tau pathology and neurodegeneration in AD are reduced in aducanumab-treated subjects

CSF pTau



CSF total Tau



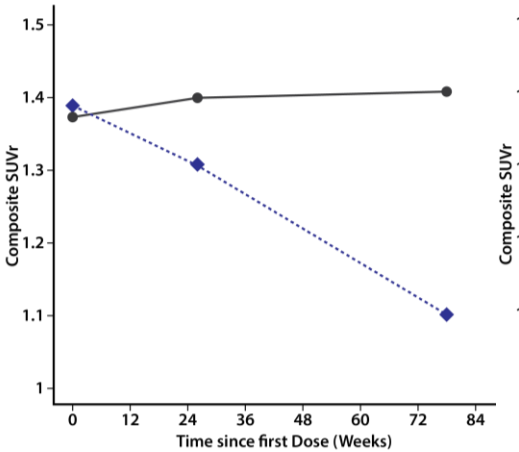
CSF pTau and CSF total Tau measured at 18 months (data analyzed using ANCOVA); n.s. = not significant

ENGAGE consistent with EMERGE in subset of patients with sufficient exposure to 10 mg/kg aducanumab

Corrected on October 28, 2019

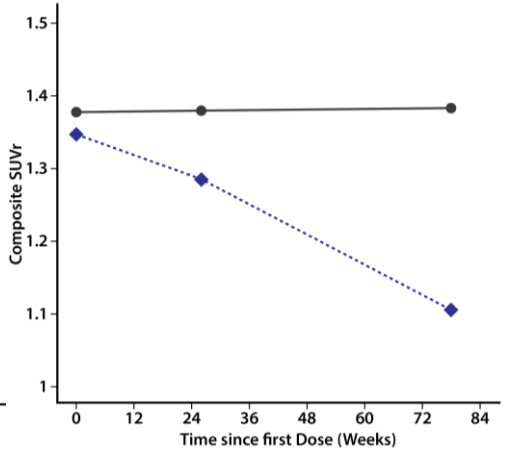
Amyloid PET

EMERGE



	Wk 0	Wk 26	Wk 78
PBO	157	128	90
ADU	55	46	43

ENGAGE



	Wk 0	Wk 26	Wk 78
PBO	203*	164*	121*
ADU	44*	39*	31*

PBO = placebo

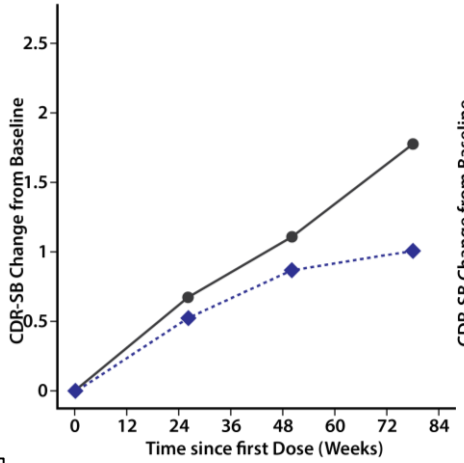
ADU = aducanumab

*Corrected numbers above vs. numbers below from original slide posted on October 22, 2019:

	Wk 0	Wk 26	Wk 78
	157	128	90
	55	46	43

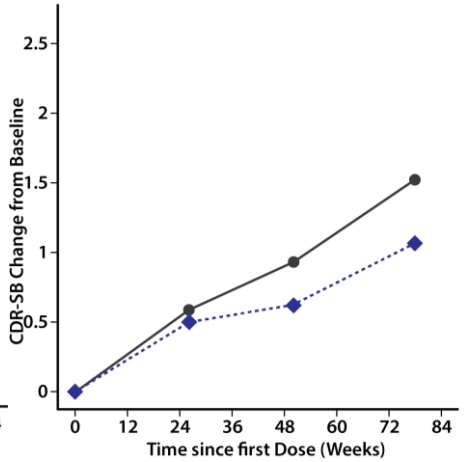
CDR-SB

EMERGE



	Wk 0	Wk 26	Wk 50	Wk 78
PBO	546	532	437	297
ADU	147	146	146	127

ENGAGE



	Wk 0	Wk 26	Wk 50	Wk 78
PBO	545	522	460	336
ADU	116	116	114	97

Placebo

≥ 10 uninterrupted 10 mg/kg dosing intervals at steady-state

Safety

- The safety and tolerability profile of aducanumab in EMERGE and ENGAGE was consistent with previous studies of aducanumab
- The most common adverse events were Amyloid-Related Imaging Abnormalities-Edema (ARIA-E, 35%) followed by headache (20%)
- The majority of patients who experienced ARIA-E (74%) did not experience symptoms during the ARIA-E episode
- ARIA-E episodes generally resolved within 4-16 weeks, typically without long-term clinical sequelae

Summary of Phase 3 aducanumab data

- Across multiple clinical endpoints, the larger aducanumab dataset demonstrated a **statistically significant reduction of clinical decline in early AD patients in EMERGE**, and Biogen believes data from a subset of ENGAGE support these findings
- **Exposure to high dose** aducanumab was important for efficacy
- Differences in exposure to high dose aducanumab largely explain the different results between the futility analysis and the new analysis of this larger dataset, as well as the different results between the two studies
- Following consultation with the FDA, Biogen believes it is reasonable to submit **a regulatory filing for aducanumab** based on these data