



Memorial Sloan Kettering  
Cancer Center

# Metastatic HER2 + Breast Cancer: Current Landscape

Chau T. Dang, MD

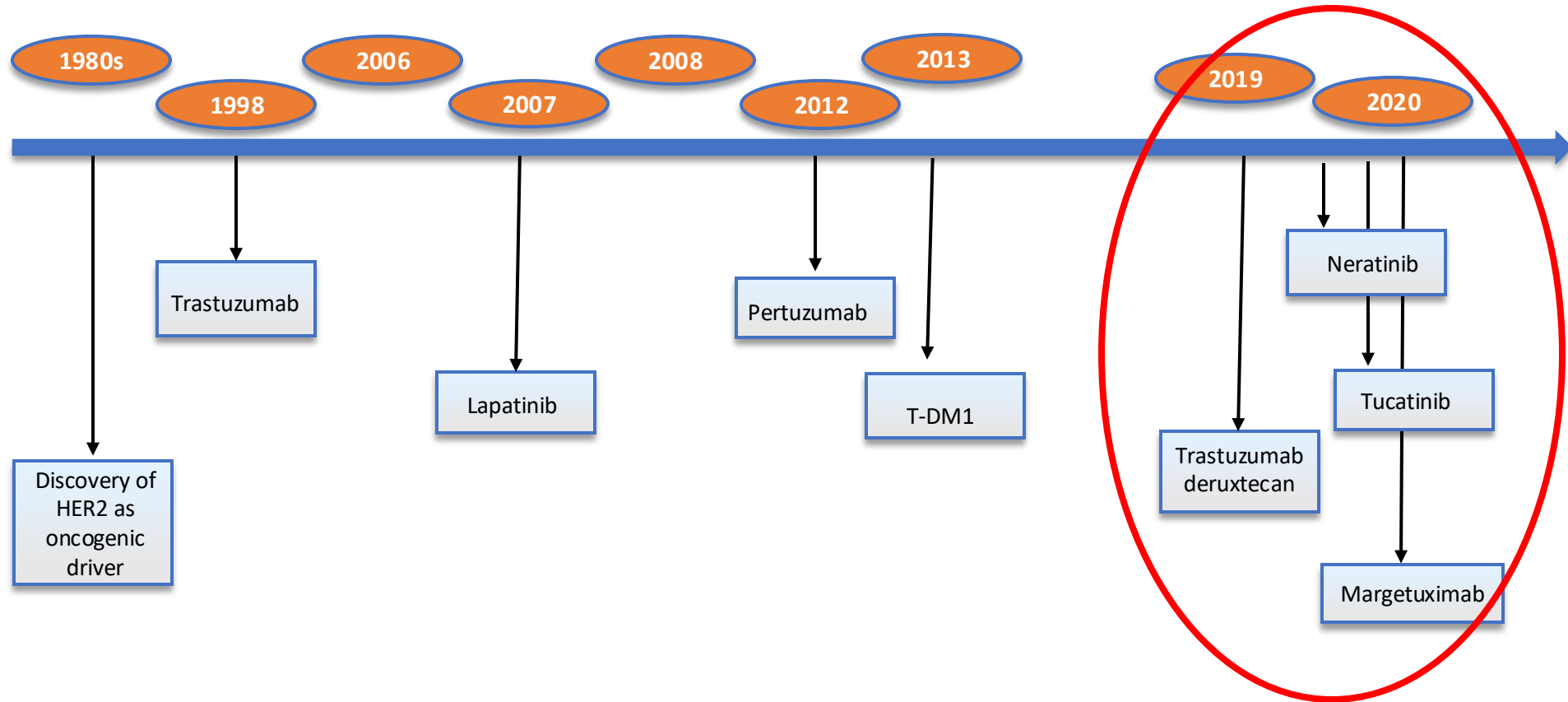
Attending, Breast Medicine Service

Memorial Sloan Kettering Cancer Center

Professor of Medicine, Weill Cornell Medical College

October 19, 2024

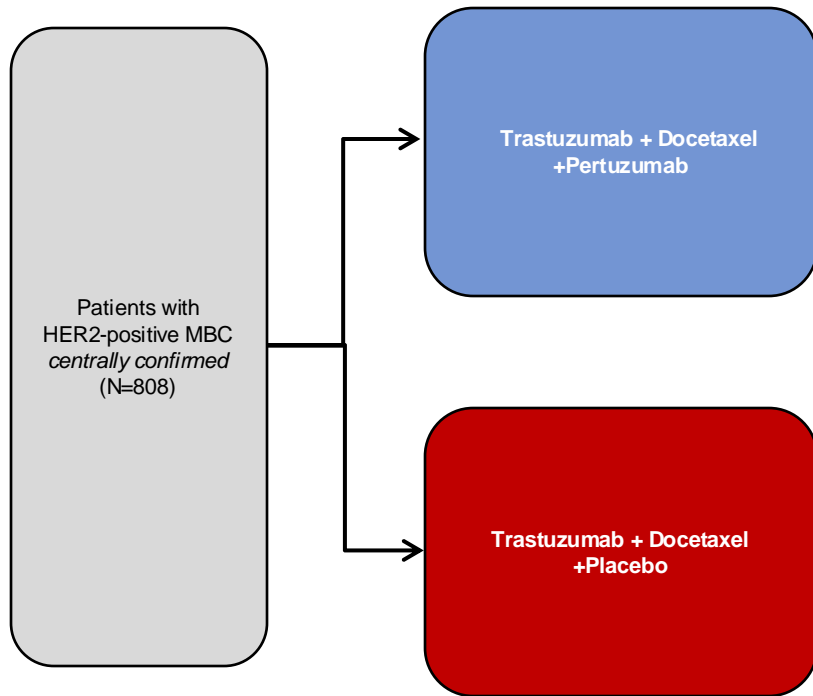
# HER2-Targeted Therapies for MBC Timeline



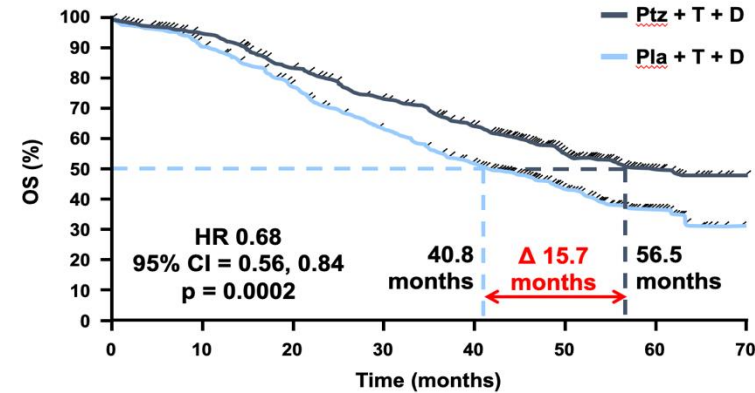
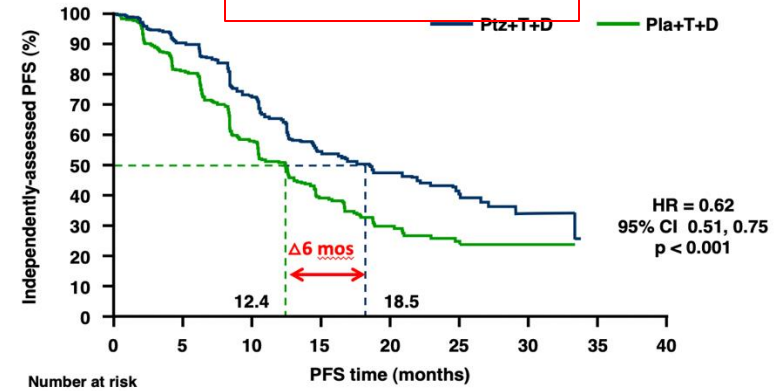
**1<sup>st</sup>-Line**

# CLEOPATRA Trial :

## Adding Pertuzumab to Docetaxel +Trastuzumab Improves PFS & OS

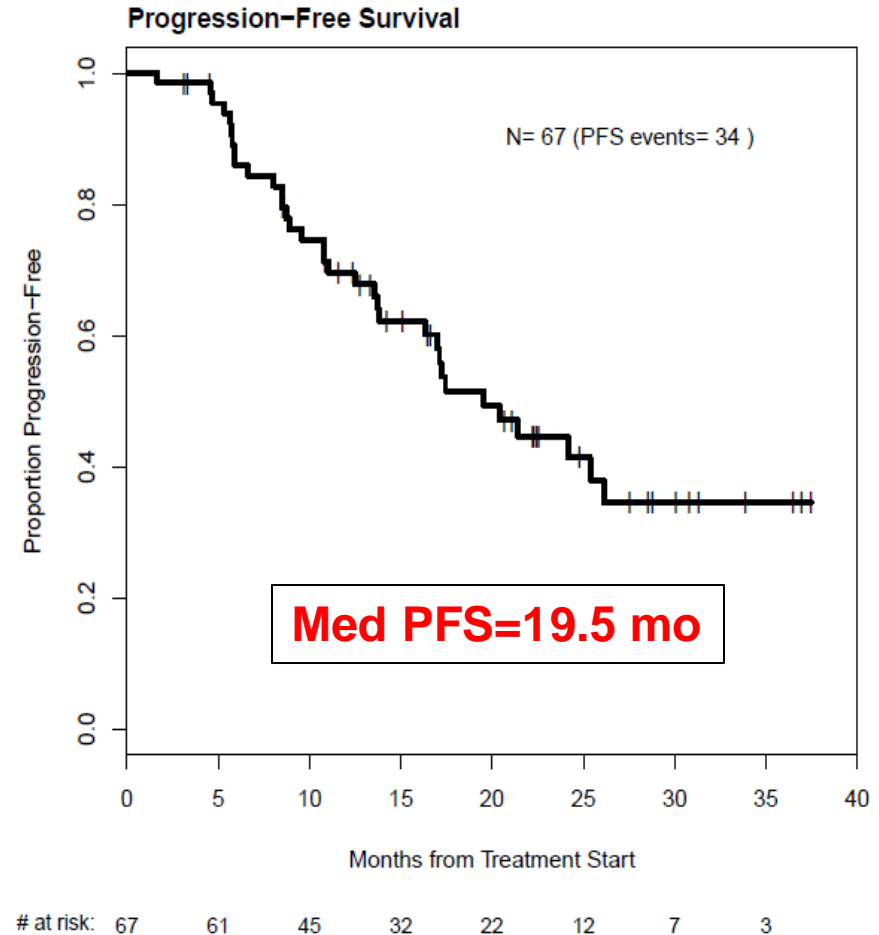
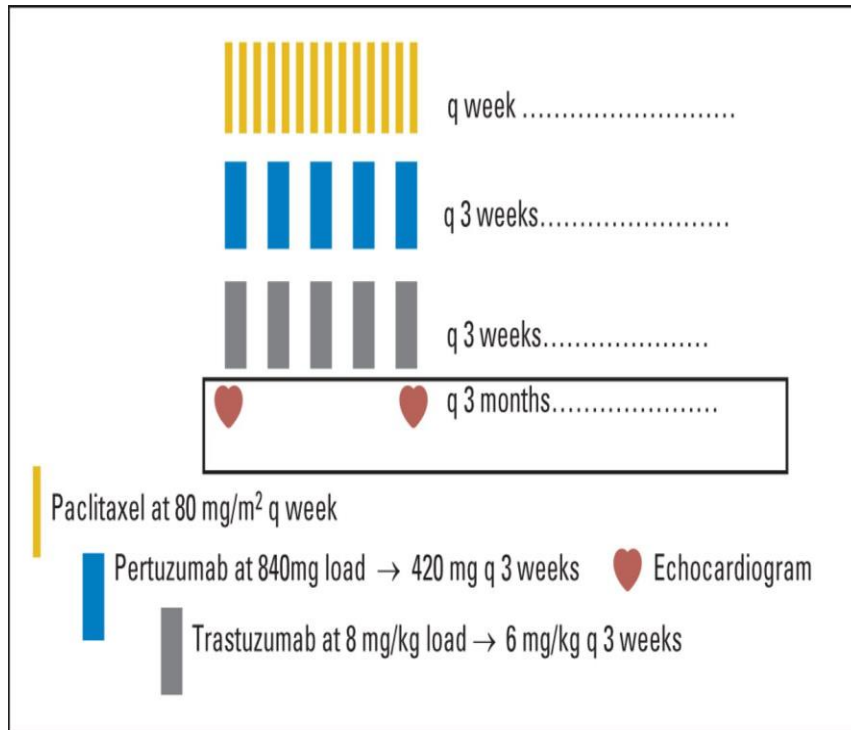


**PFS**  
**12.4 vs 18.5 m**  
**P < 0.001**



**OS**  
**40.8 vs 56.5 m**  
**P = 0.0002**

# NCCN/ASCO Guidelines: Preferred 1<sup>st</sup> line: Taxane + Trastuzumab+ Pertuzumab



1. [http://www.nccn.org/professionals/physician\\_gls/pdf/breast.pdf](http://www.nccn.org/professionals/physician_gls/pdf/breast.pdf)JM
2. Giordano et al. JCO 2018
3. Dang et al. JCO 2015

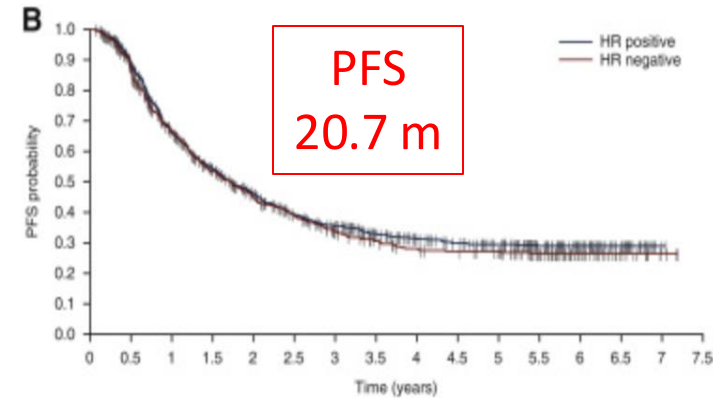
# PERUSE: 1<sup>st</sup> Line Trastuzumab/Pertuzumab + Taxane in HER2+ MBC

## Choice of docetaxel, paclitaxel or nab-paclitaxel

Median PFS was 20.7m and similar regardless of taxane backbone or HR status

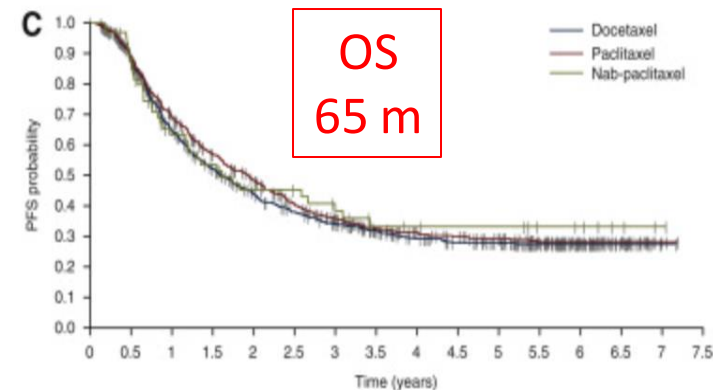
Median OS was 65 m and was similar regardless of taxane; it was longer for HR+ cases, lending support for the use of maintenance ET

N=1436; Median f/u approx. 6 yrs



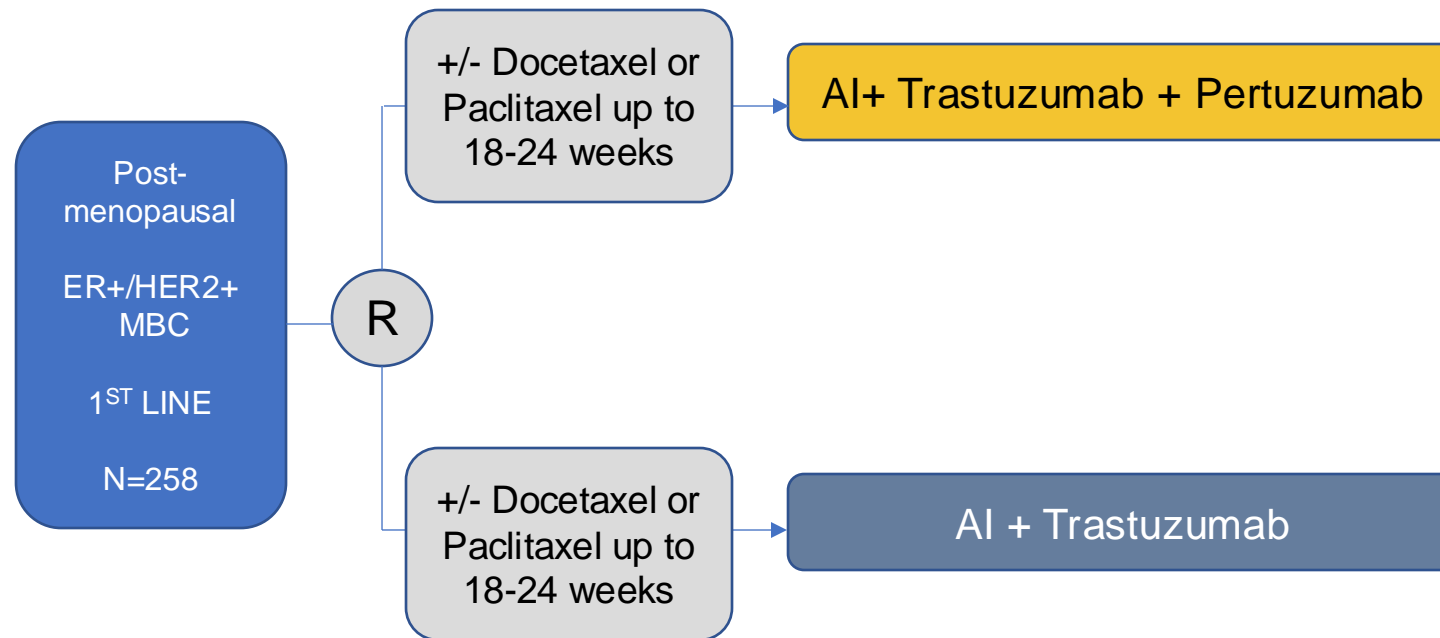
Number at risk

HR positive	918	753	524	419	341	279	245	200	174	155	137	96	62	29	1	0
HR negative	512	417	296	225	183	151	122	103	90	85	79	59	32	12	3	0



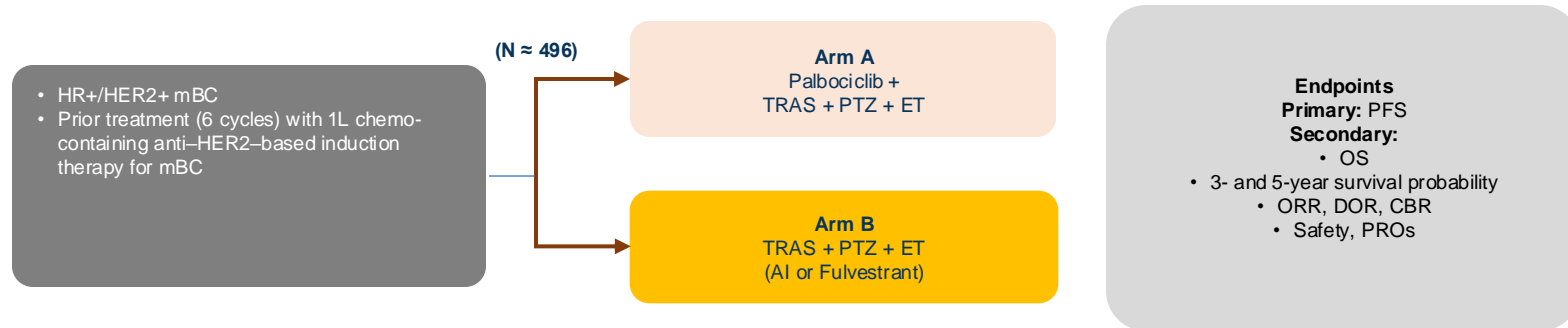
# Can HR+ HER2+ MBC be treated without chemotherapy?

## PERTAIN 1<sup>st</sup> Line Trial: Phase 2 Study for HR+ HER2+ MBC

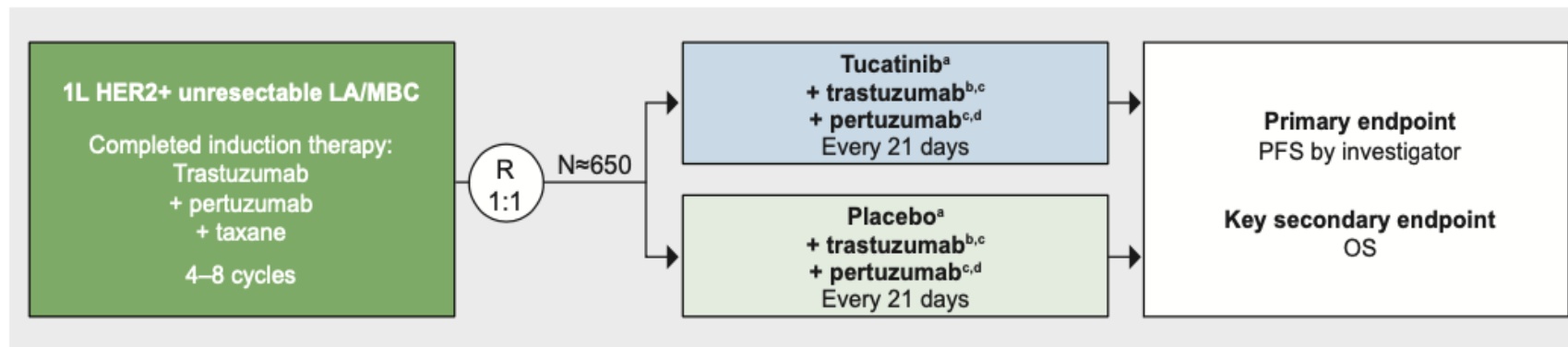


# Randomized Phase 3 Trials in the Trastuzumab/Pertuzumab Maintenance Setting in HER2+ MBC

## PATINA TRIAL



## HER2CLIMB-05 TRIAL

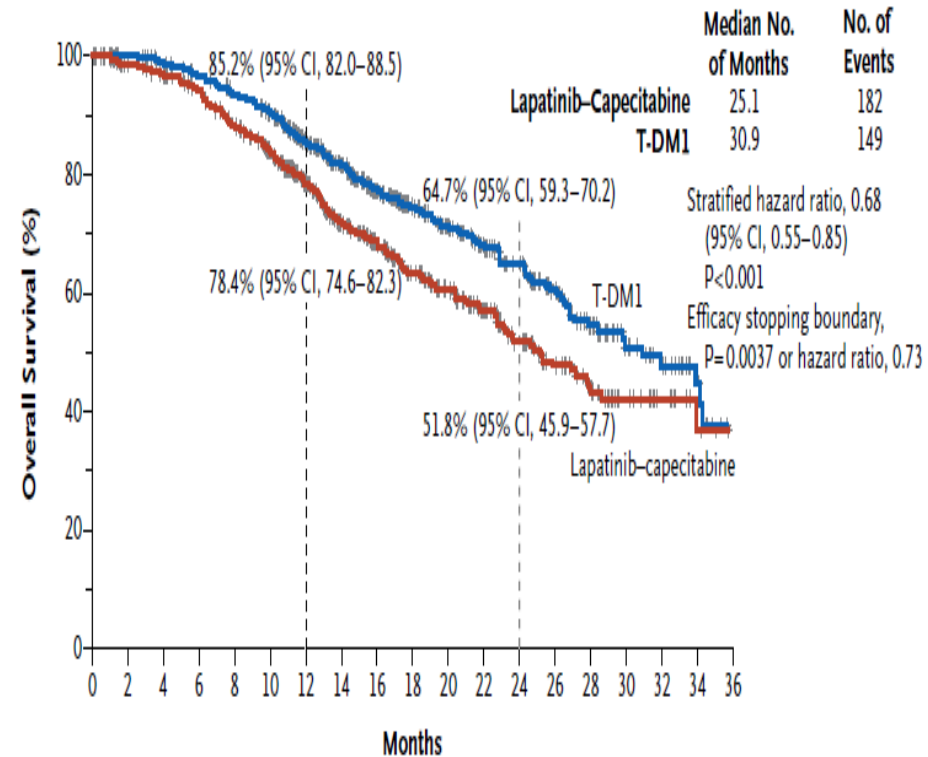
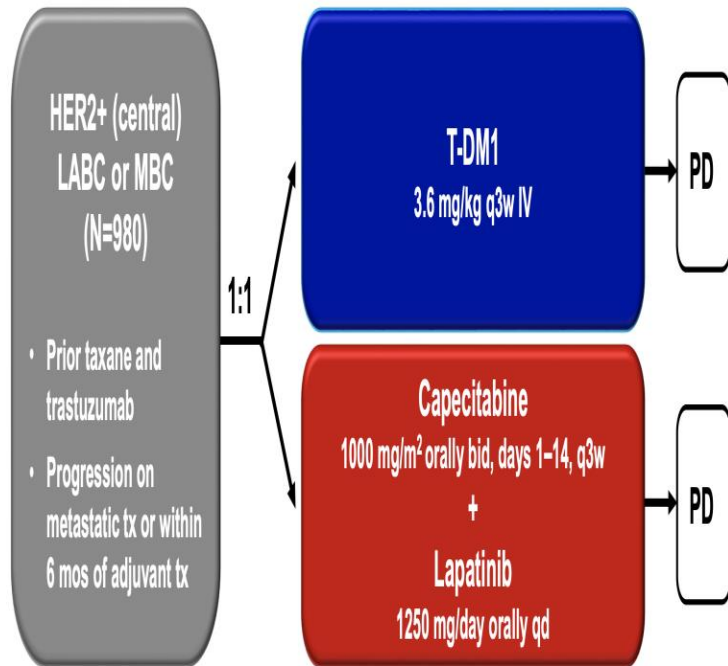




**2<sup>nd</sup>-Line**

# EMILIA: TDM1 superior to Capecitabine+Lapatinib in HER2+ MBC

**OS**  
**25.1 m vs 30.9 m**  
**HR 0.68**

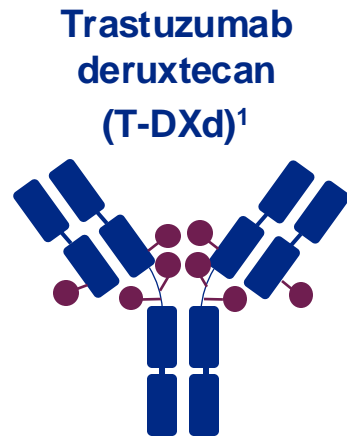


**2013 Standard of Care 2<sup>nd</sup> Line Therapy**

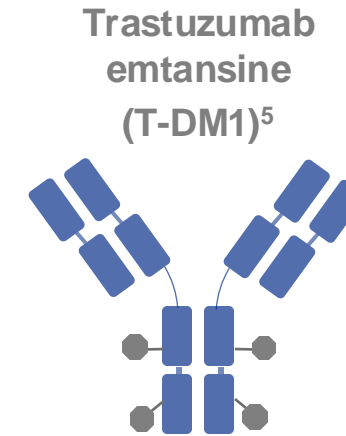
# Trastuzumab Deruxtecan (T-DXd): a Novel HER2 ADC

## Characteristic Differences Between T-DXd and T-DM1

HER2 Targeting ADCs with similar mAB Backbone



T-DXd <sup>1-4,a</sup>	ADC Attributes	T-DM1 <sup>3-5</sup>
Topoisomerase I inhibitor	<b>Payload MoA</b>	Anti-microtubule
~8:1	<b>Drug-to-antibody ratio</b>	~3.5:1
Yes	<b>Tumor-selective cleavable linker?</b>	No
Yes	<b>Evidence of bystander anti-tumor effect?</b>	No



ADC, antibody-drug conjugate; MoA, mechanism of action.

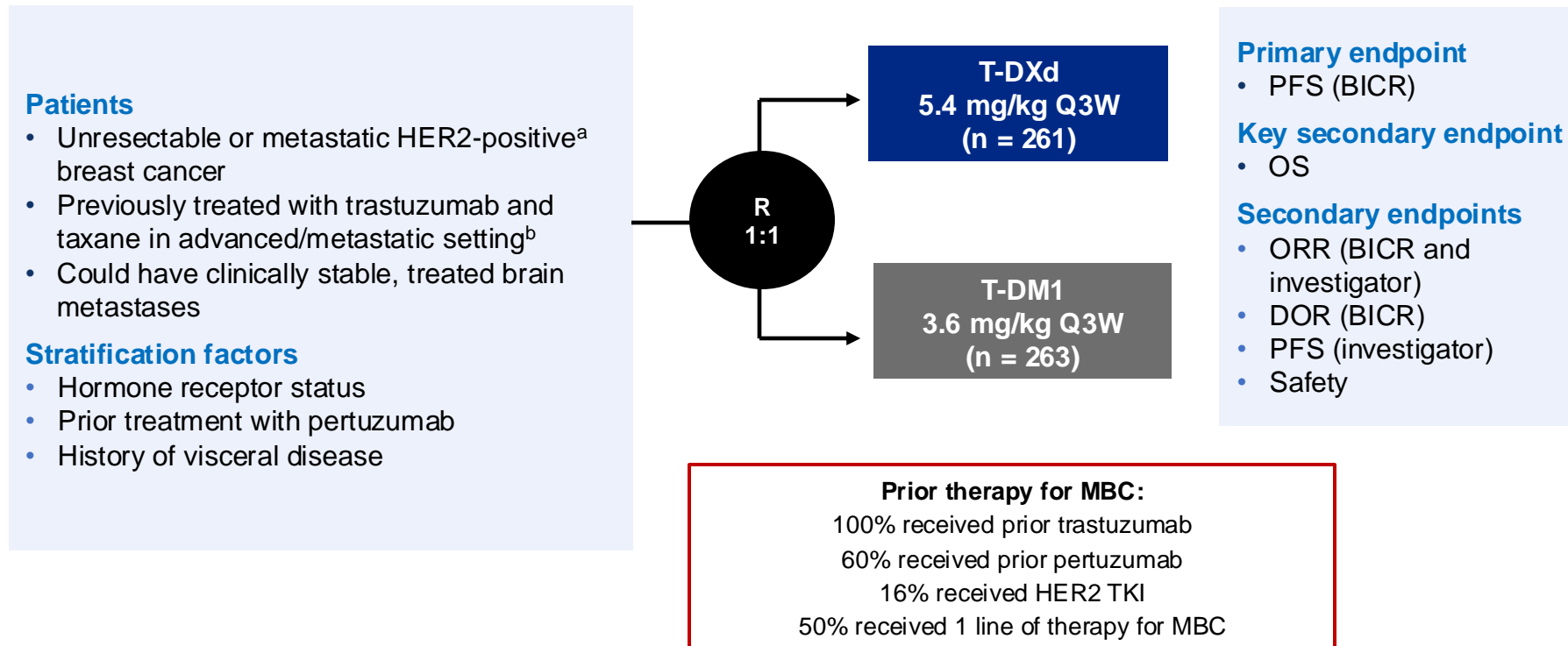
<sup>a</sup>The clinical relevance of these features is under investigation.

1. Nakada T et al. *Chem Pharm Bull (Tokyo)*. 2019;67:173-85. 2. Ogitani Y et al. *Clin Cancer Res*. 2016;22:5097-108. 3. Trail PA et al. *Pharmacol Ther*. 2018;181:126-42. 4. Ogitani Y et al. *Cancer Sci*. 2016;107:1039-46. 5. LoRusso PM et al. *Clin Cancer Res*. 2011;17:6437-47.

Cortes, J et al. ESMO 2021

# DESTINY Breast-03: First Randomized Ph3 Study of T-DXd

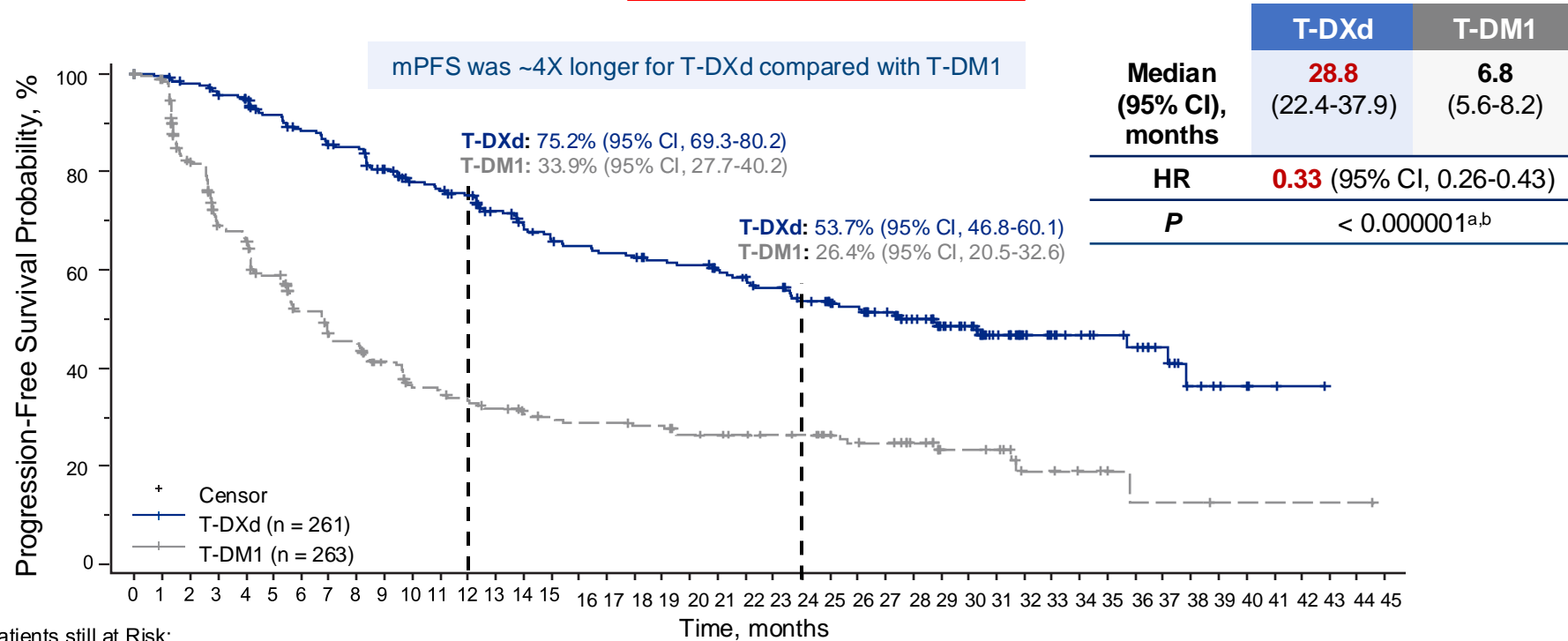
- An open-label, multicenter study (NCT03529110)



<sup>a</sup>HER2 IHC3+ or IHC2+/ISH+ based on central confirmation. <sup>b</sup>Progression during or <6 months after completing adjuvant therapy involving trastuzumab and taxane

# DB-03 Updated Primary Endpoint: PFS

**PFS**  
**28.8 m vs 6.8 m**

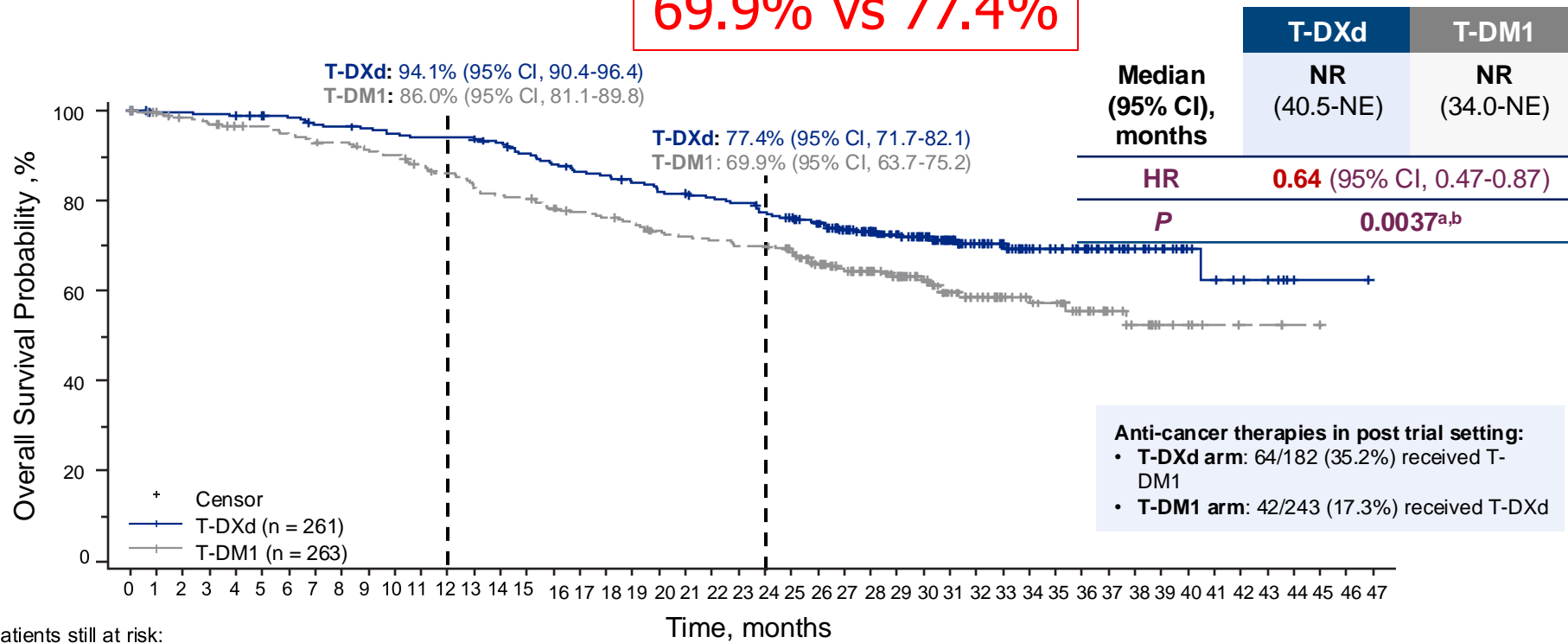


Patients still at Risk:

T-DXd	261	256	250	244	240	225	216	207	205	191	176	173	167	154	146	140	134	131	130	125	123	117	113	107	99	96	90	82	73	64	55	41	32	28	23	20	18	13	7	5	4	2	1	0		
T-DM1	263	253	201	164	156	134	111	99	96	81	69	67	63	58	54	51	49	49	47	47	42	41	39	37	36	32	28	27	22	19	15	14	8	7	6	4	2	2	2	1	1	1	1	1	1	0

# DB-03 Key Secondary Endpoint: Overall Survival

**24 m OS  
69.9% vs 77.4%**



Patients still at risk:

T-DXd 261 256 256 255 254 251 249 244 243 241 238 236 236 236 231 224 218 213 211 206 201 200 196 193 187 182 173 156 142 124 109 91 73 64 51 44 38 30 22 18 11 9 7 6 1 1 1 0

T-DM1 263 257 252 248 243 242 237 233 232 227 224 217 211 203 199 197 191 186 183 179 172 169 167 164 164 158 140 129 117 106 90 70 59 45 41 38 27 20 15 8 7 4 3 3 1 1 0

HR, hazard ratio; mOS, median overall survival; NE, not estimable; NR, not reached; T-DM1, trastuzumab emtansine; T-DXd, trastuzumab deruxtecan. There were 19 patients (7.3%) treated with T-DXd and 28 patients (10.6%) treated with T-DM1 who were lost to follow-up.

<sup>a</sup>The P value for overall survival crossed the prespecified boundary (P = 0.013) and was statistically significant. <sup>b</sup>Two-sided from stratified log-rank test.

**T-DXd preferred 2<sup>nd</sup> line Rx !**

Hurvitz S et al, SABC 2022  
Hurvitz S. et al. Lancet Onc 2023

# DESTINYBreast-03 Incidence of Adjudicated ILD/Pneumonitis Events

CTCAE Grade Per Adjudication Committee	ENHERTU (n = 257)	T-DM1 (n = 261)
<b>Adjudicated as study drug-related ILD/pneumonitis, n (%)</b>		
Any grade	39 (15.2)	8 (3.1)
1	11 (4.3)	4 (1.5)
2	26 (10.1)	3 (1.1)
3	2 (0.8)	1 (0.4)
4	0	0
5	0	0



## Drug-Related ILD (DILD) Results

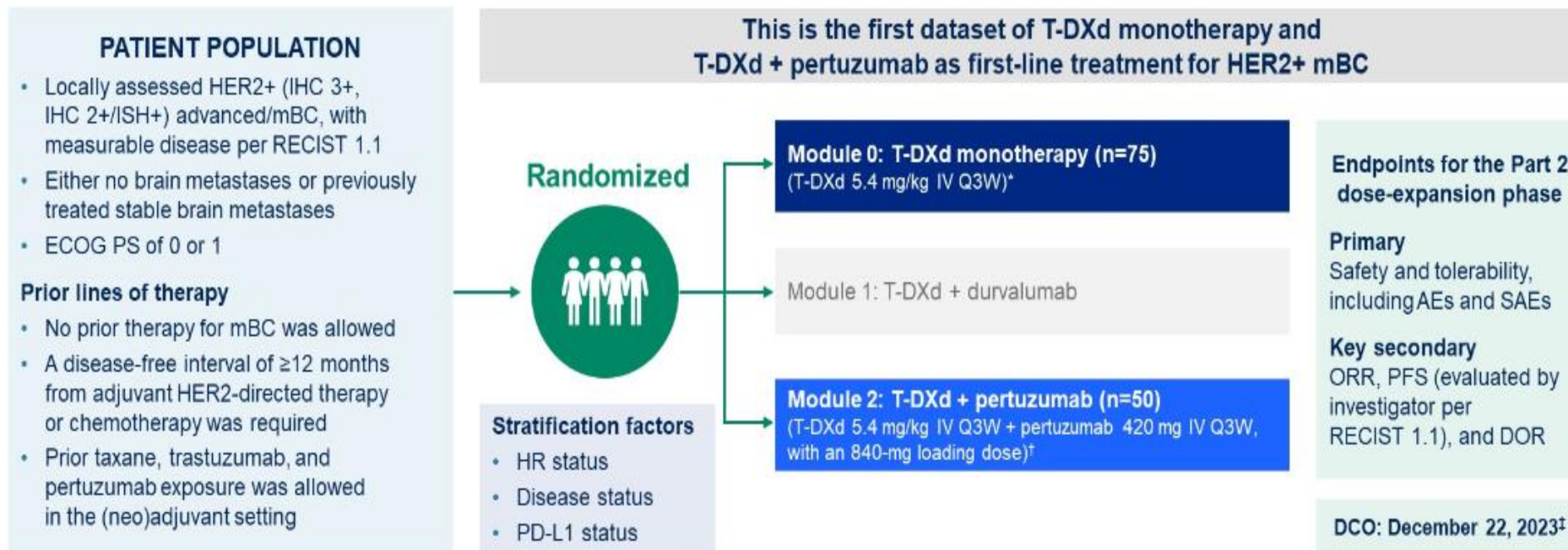
- Adjudicated DILD/pneumonitis rates were similar to other mBC trials with ENHERTU
- ENHERTU had a higher overall DILD/pneumonitis incidence (15.2%) versus T-DM1 (3.1%)
- Majority of events (94.9%; n = 37/39) were grade 1 or 2, and the overall incidence of grade 3 adjudicated DILD/pneumonitis was 0.8% in the ENHERTU arm
- No grade 4/5 adjudicated DILD/pneumonitis was reported in either arm

**CTCAE**, Common Terminology Criteria for Adverse Events; **DILD**, drug-related interstitial lung disease; **ILD**, interstitial lung disease; **mBC**, metastatic breast cancer; **T-DM1**, ado-trastuzumab emtansine.

# DESTINY Breast 07

## Study design

DESTINY-Breast07: a Phase 1b/2, multicenter, open-label, two-part, modular study (NCT04538742)



Results reported here are from an interim analysis of the Part 2 dose-expansion phase for Modules 0 and 2 only; the Part 1 dose-finding phase of the study has been described previously<sup>1</sup>

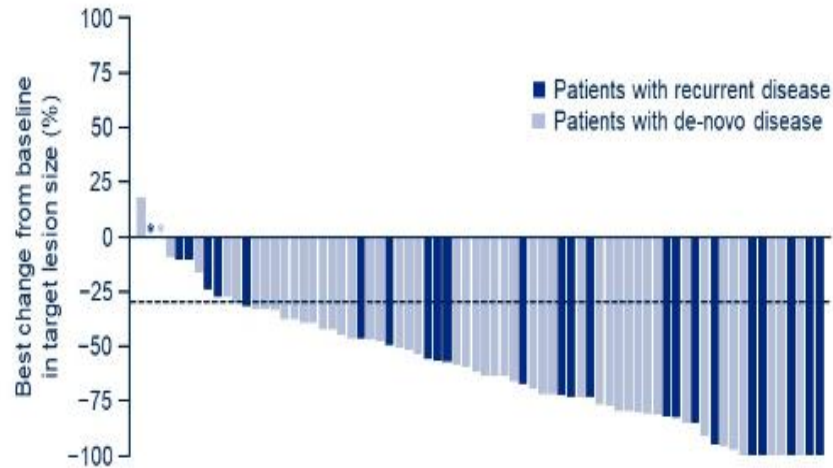
\*Patients in Module 0 received the approved T-DXd dose for HER2+ breast cancer; †patients received the RP2D from the study's dose-finding phase; ‡the corresponding abstract reported data from the August 1, 2023, DCO  
AE, adverse event; DCO, data cutoff; DOR, duration of response; ECOG PS, Eastern Cooperative Oncology Group performance status; HER2, human epidermal growth factor receptor 2; HER2+, human epidermal growth factor receptor 2-positive; HR, hormone receptor; IHC, immunohistochemistry; ISH+, in situ hybridization-positive; IV, intravenous; mBC, metastatic breast cancer; ORR, objective response rate; PD-L1, programmed cell death ligand 1; PFS, progression-free survival; Q3W, every 3 weeks; RECIST 1.1, Response Evaluation Criteria in Solid Tumours version 1.1; RP2D, recommended Phase 2 dose; SAE, serious adverse event; T-DXd, trastuzumab deruxtecan  
1. André F, et al. Poster presented at ASCO 2022 (Abstract 3025)



# DESTINY Breast 07

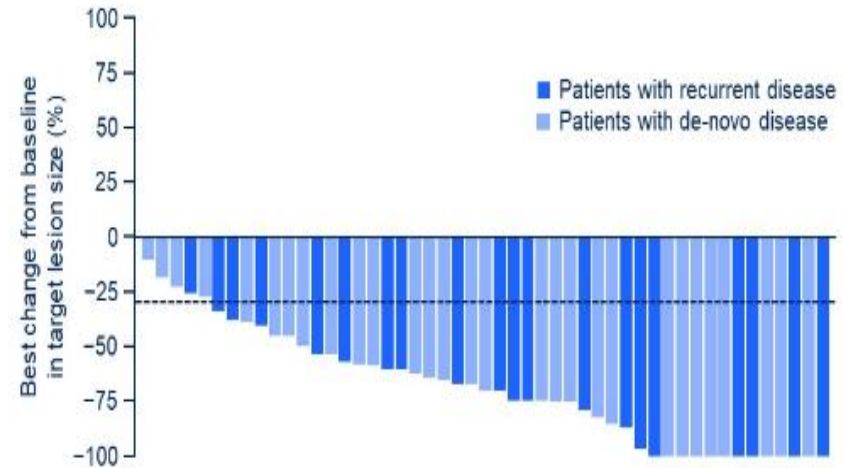
## Response to treatment per RECIST 1.1 by investigator

### T-DXd monotherapy (n=75)



<b>Confirmed ORR, % (80% CI)</b>	76.0 (68.5–82.4)
Complete response, n (%)	6 (8.0)
Partial response, n (%)	51 (68.0)
<b>Median DOR, months (range)</b>	NE (2.1–28.5)

### T-DXd + pertuzumab (n=50)



<b>Confirmed ORR, % (80% CI)</b>	84.0 (75.3–90.5)
Complete response, n (%)	10 (20.0)
Partial response, n (%)	32 (64.0)
<b>Median DOR, months (range)</b>	NE (4.5–28.3)

Dashed reference line at -30% indicates the threshold for partial response

Responses are captured for patients with baseline data and at least one follow-up assessment

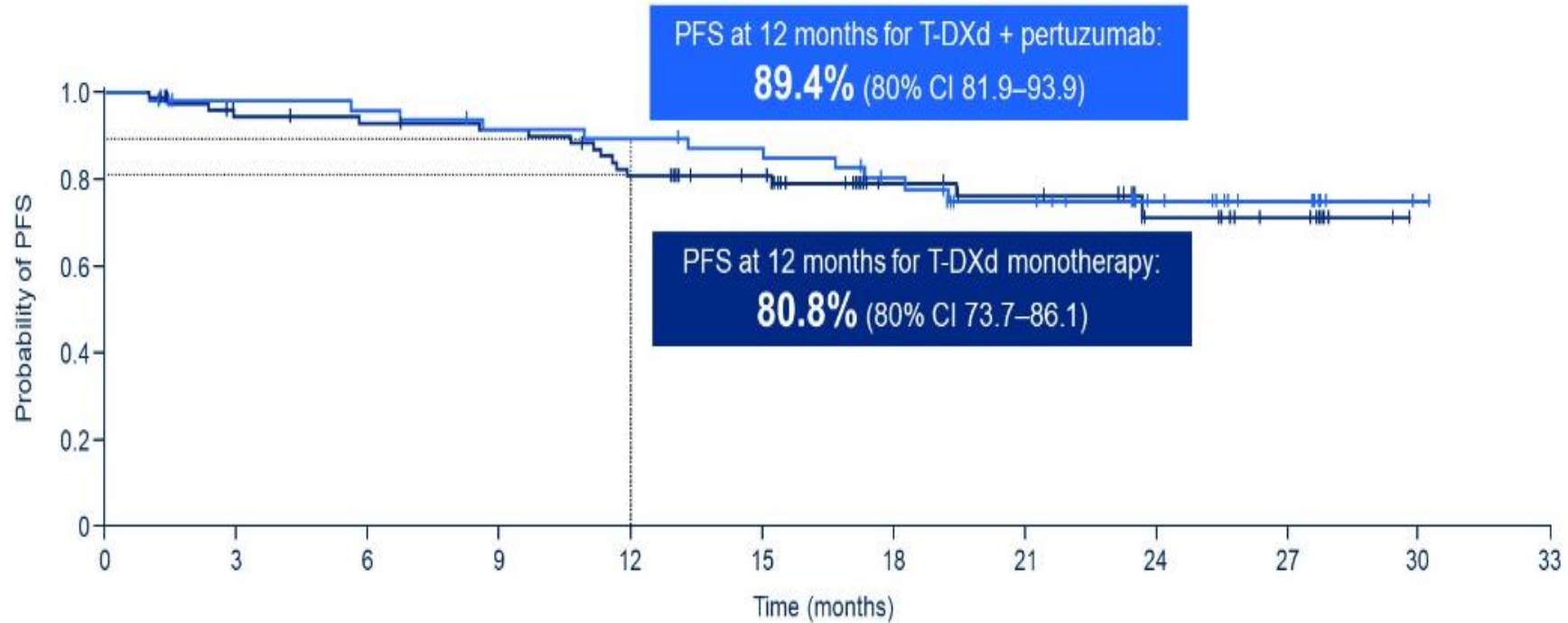
DCO was December 22, 2023. Median duration of follow up was 23.9 months for T-DXd monotherapy and 25.3 months for T-DXd + pertuzumab

\*Patients had 0% change from baseline

CI, confidence interval; DCO, data cutoff; DOR, duration of response; NE, not evaluable; ORR, objective response rate; RECIST 1.1, Response Evaluation Criteria in Solid Tumours version 1.1; T-DXd, trastuzumab deruxtecan

# DESTINY Breast 07

## Progression-free survival



Number at risk		0	3	6	9	12	15	18	21	24	27	30	33
T-DXd monotherapy	75	65	63	61	53	47	27	24	13	8	0	0	0
T-DXd + pertuzumab	50	46	45	42	41	38	31	23	13	7	1	0	0

Number of randomized patients / number of events	
T-DXd monotherapy	75 / 16
T-DXd + pertuzumab	50 / 11

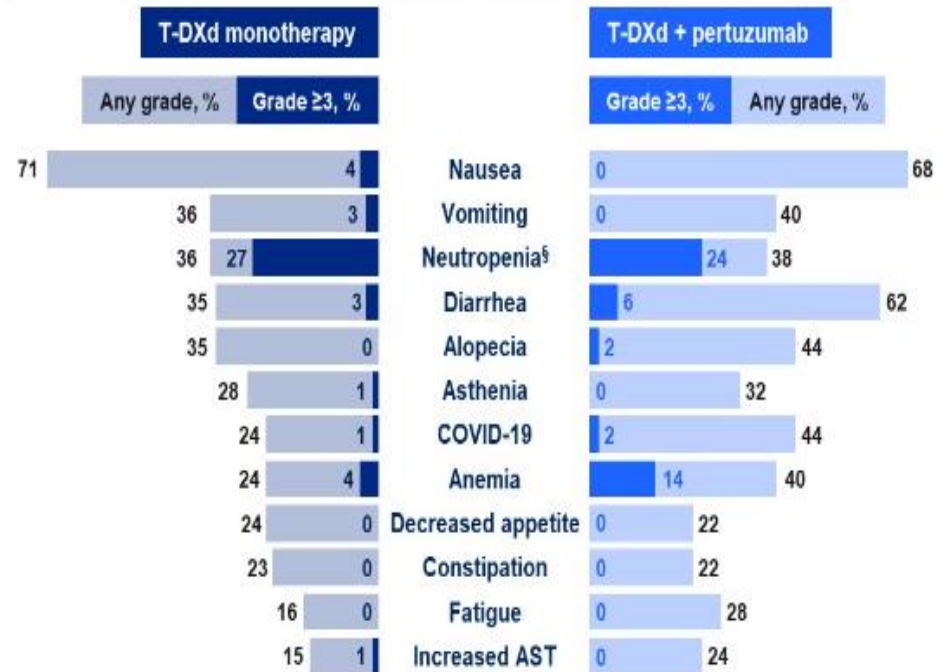
The number of PFS events is small, and most patients were censored  
 DCO was December 22, 2023. Median duration of follow up was 23.9 months for T-DXd monotherapy and 25.3 months for T-DXd + pertuzumab  
 CI, confidence interval; DCO, data cutoff; PFS, progression-free survival; T-DXd, trastuzumab deruxtecan

# DESTINY Breast 07

## Safety overview

	T-DXd monotherapy (n=75)	T-DXd + pertuzumab (n=50)
<b>Median actual treatment duration, months (range)*</b>		
T-DXd	16.3 (0.7–30.9)	17.8 (0.9–30.7)
Pertuzumab	N/A	17.6 (0.9–30.7)
<b>Any AE, n (%)</b>	75 (100)	50 (100)
<b>Any AEs Grade ≥3, n (%)</b>	39 (52.0)	31 (62.0)
<b>AEs associated with drug interruptions of T-DXd, n (%)</b>	44 (58.7)	32 (64.0)
<b>AEs associated with dose reduction of T-DXd, n (%)</b>	12 (16.0)	8 (16.0)
<b>AEs associated with discontinuation of T-DXd, n (%)<sup>†</sup></b>	8 (10.7)	8 (16.0)
<b>Any SAEs, n (%)</b>	13 (17.3)	13 (26.0)
<b>AEs leading to death, n (%)</b>	1 (1.3) <sup>‡</sup>	0
<b>AESIs, n (%)</b>		
Pneumonitis (adjudicated as ILD related to T-DXd)	7 (9.3)	7 (14.0)
Grade 1	2 (2.7)	0
Grade 2	5 (6.7)	6 (12.0)
Grade 3	0	1 (2.0)
LV dysfunction (possibly related to T-DXd)	5 (6.7)	2 (4.0)

### Any-grade AEs (>20% of patients in either module) with incidence of Grade ≥3 events



#### Grade 2 diarrhea events were reported in:

- 13.3% of patients in the T-DXd monotherapy module
- 32.0% of patients in the T-DXd + pertuzumab module

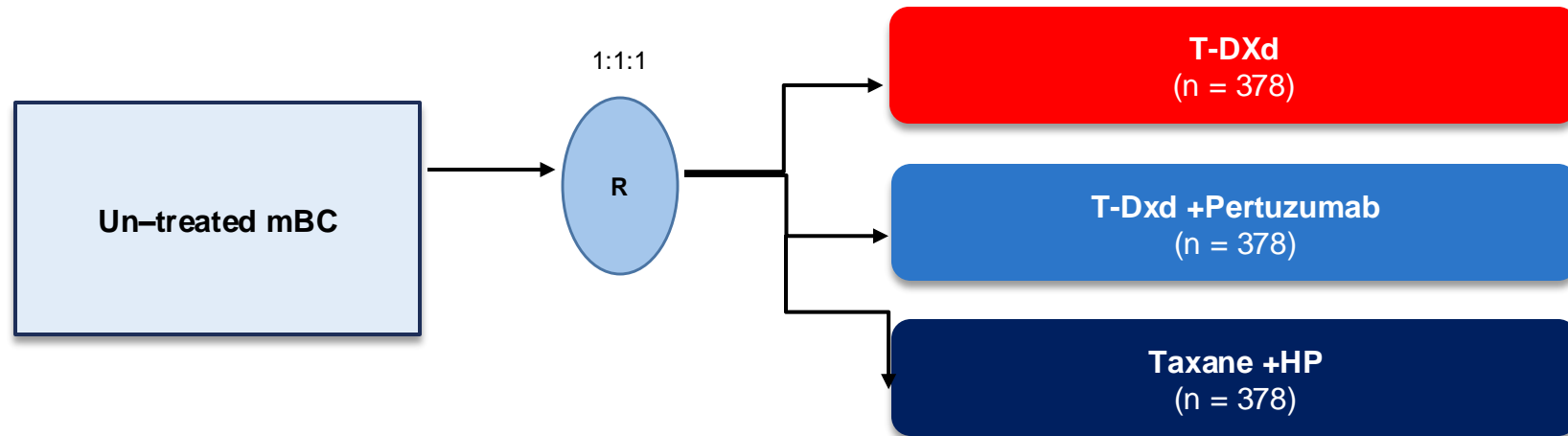
DCO was December 22, 2023

\*Total treatment duration, excluding dose delays; <sup>†</sup>discontinuation of T-DXd due to toxicities resulted in the discontinuation of pertuzumab until resolved; <sup>‡</sup>reported by investigator as non-treatment-related post-acute COVID-19 syndrome; <sup>§</sup>grouped term including neutropenia, decreased neutrophil count, and febrile neutropenia events

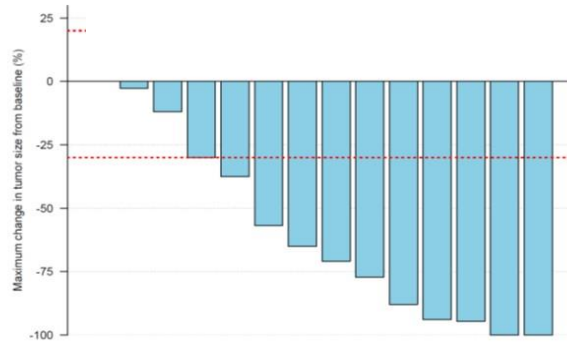
AE, adverse event; AESI, adverse event of special interest; AST, aspartate aminotransferase; COVID-19, coronavirus disease 2019; DCO, data cutoff; ILD, interstitial lung disease; LV, left ventricular; N/A, not applicable; SAE, serious adverse event; T-DXd, trastuzumab deruxtecan

# DESTINY Breast-09 Trial : 1<sup>st</sup> Line HER2+ MBC

Primary Endpoint: PFS

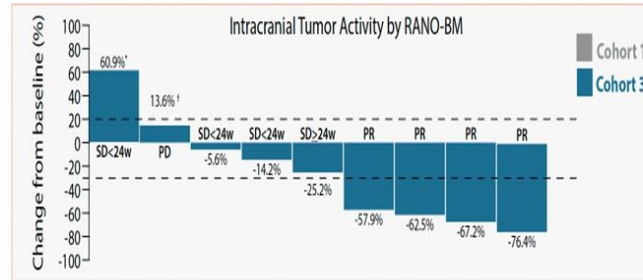


# CNS Activity of TDXd in Pts with HER2+ Breast Cancer Brain Metastases



TUXEDO-1 trial  
Bartsch et al, ESMO Breast 2022

ORR-IC = **73%** in pts with active BM



DEBBRAH trial  
Vaz Batista et al, SABCS 2021

ORR-IC = **44%** in pts with Active BM

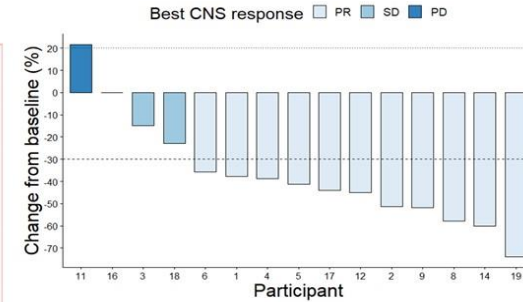


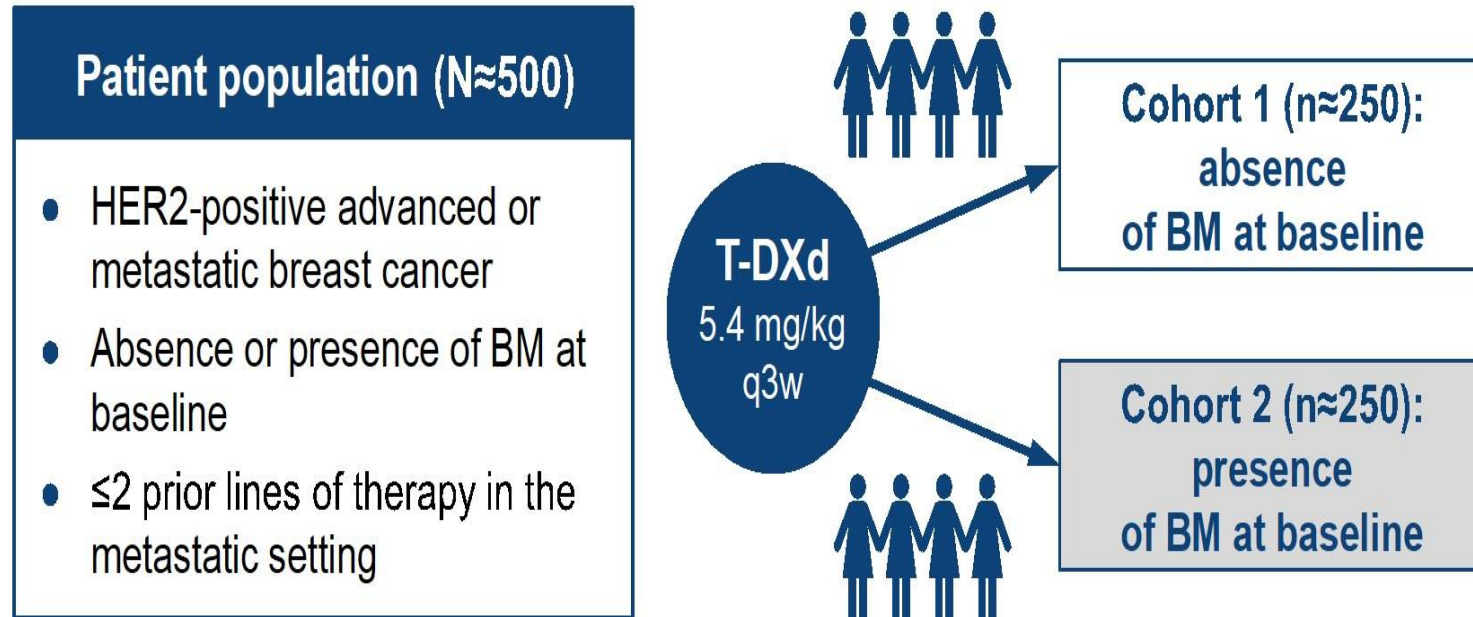
Figure 5 : Best CNS response to T-DXd. Waterfall plot of best CNS response in participants with measurable disease (n = 15). PR = partial response

DFCI/Duke/MDACCC series  
Kabraji et al, SABCS 2021

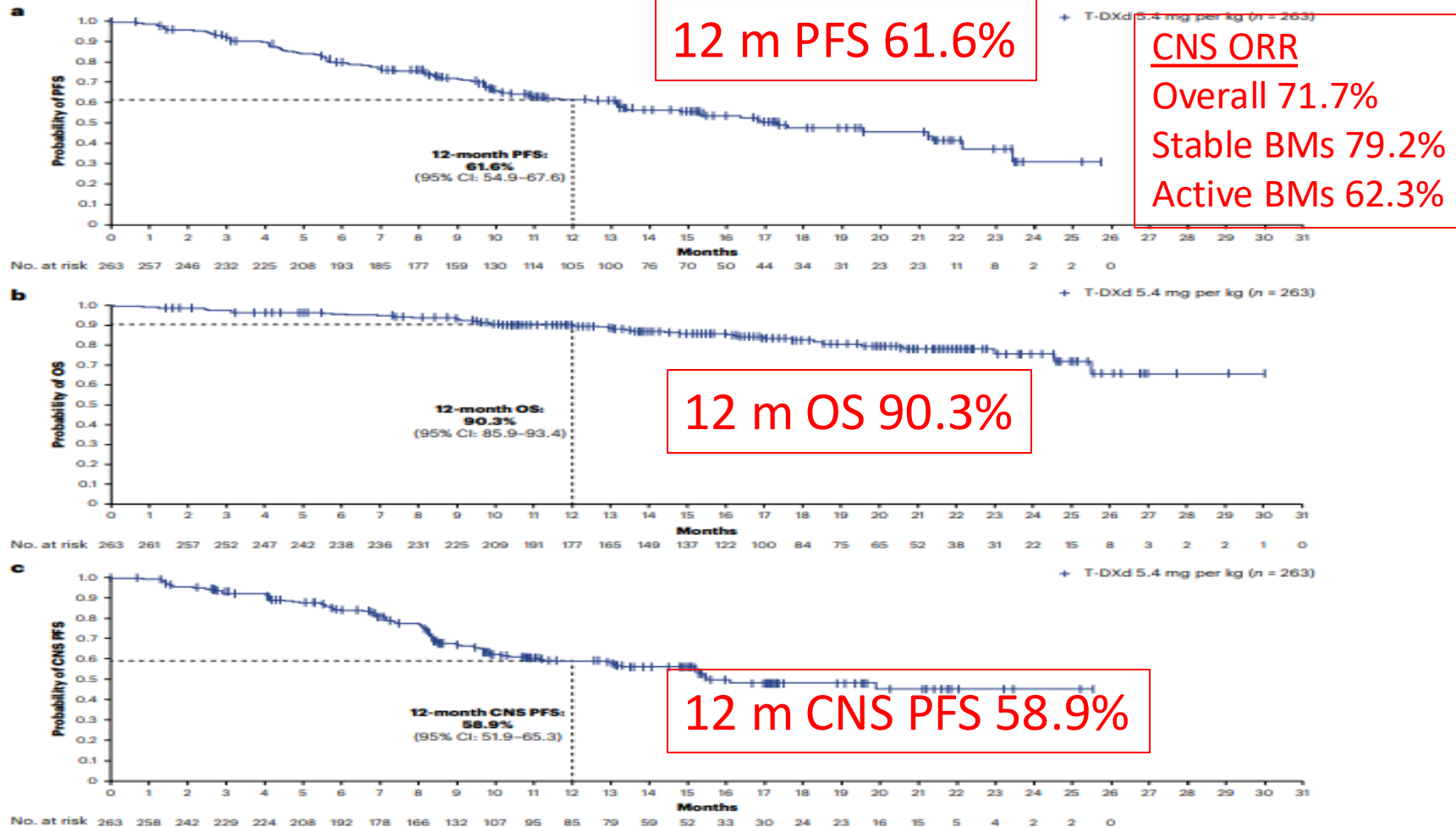
ORR-IC = **73%**  
(70% in pts with active BM)

# DESTINY-Breast12

## Study Design and Population



# 12 month PFS, OS and CNS PFS

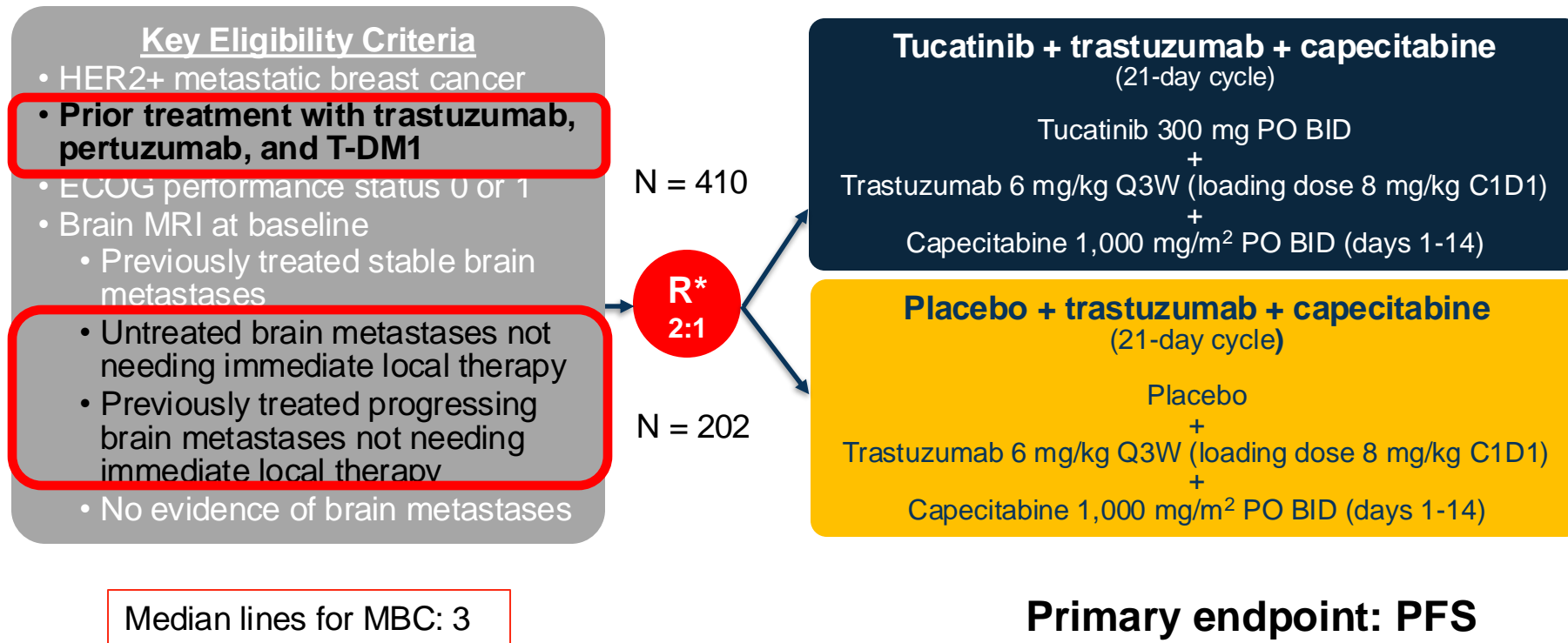


**Fig. 2 | Kaplan–Meier analysis of key efficacy endpoints in patients with baseline BMs. a, Overall PFS. b, OS. c, CNS PFS per RECIST 1.1 as assessed by ICR. Tick marks indicate censored data. Analysis was based on the full analysis set.**

**3<sup>rd</sup>-Line**



# HER2 CLIMB: RANDOMIZED PHASE II TRIAL

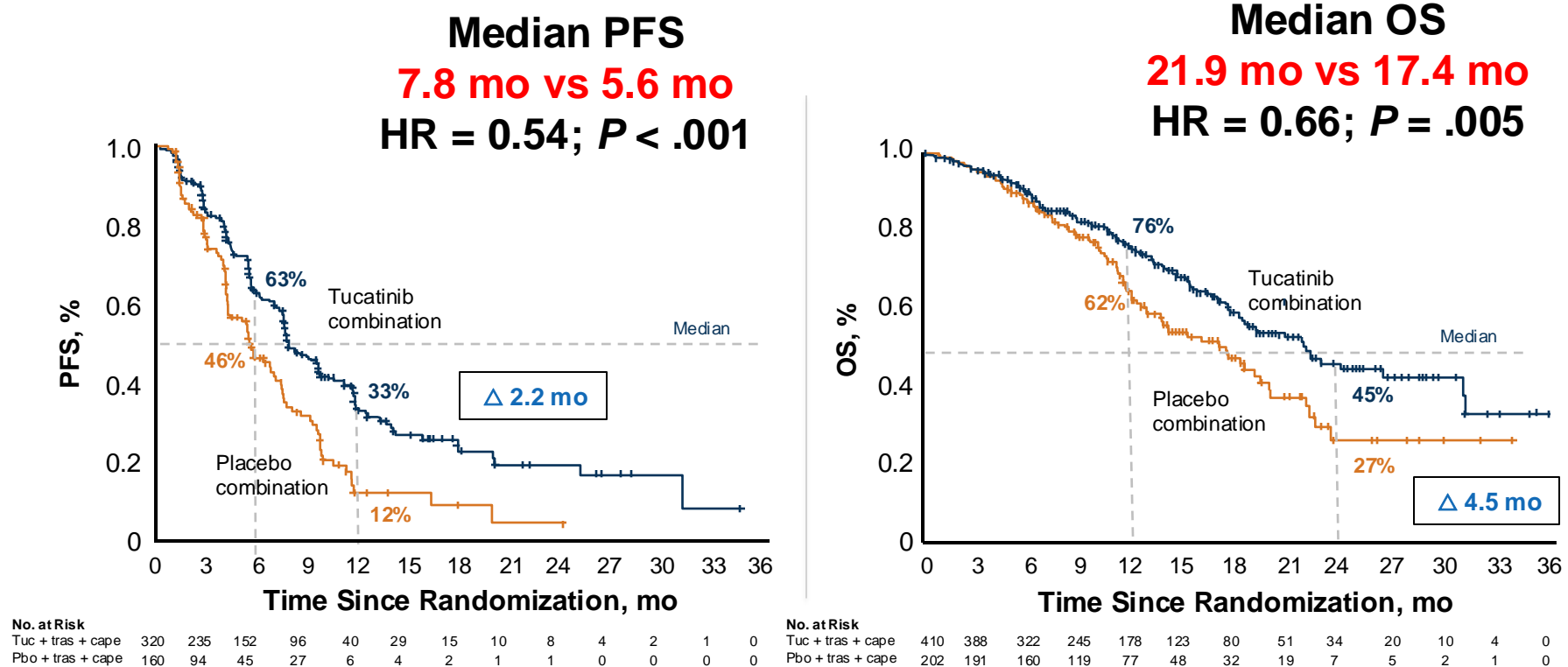


\*Stratification factors: presence of brain metastases (yes/no), Eastern Cooperative Oncology Group (ECOG) status (0 or 1), and region (United States or Canada or rest of world); MRI = magnetic resonance imaging; Q3W = every 3 weeks; Murthy R, et al. *N Engl J Med.* 2020;382(7):597-609.

# HER2 CLIMB: Randomized Phase 2 Trial of Tucatinib

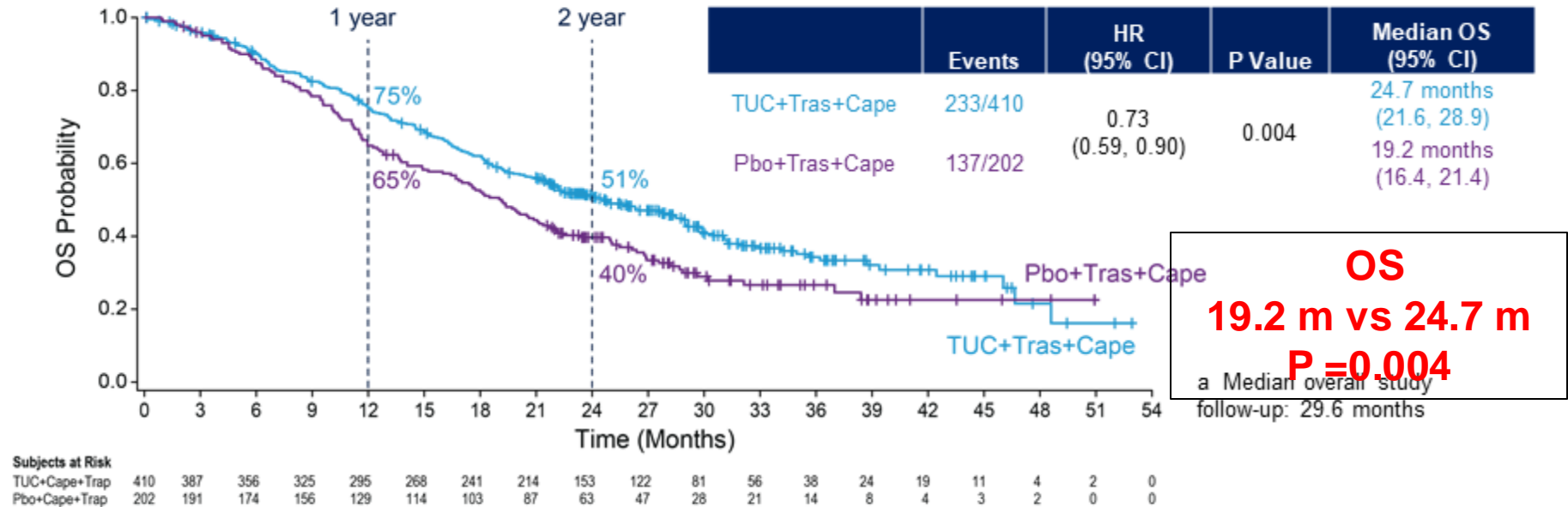
Median duration of followup of 14mo

**Tucatinib Improves PFS and OS**



# HER2CLIMB: Updated Overall Survival

Median follow-up 29.6 months



- OS benefit with tucatinib was maintained with longer follow-up, with a 5.5 month improvement in median OS in the tucatinib arm compared to the placebo arm.
- Sensitivity analyses accounting for cross-over showed consistent results with ITT analysis.

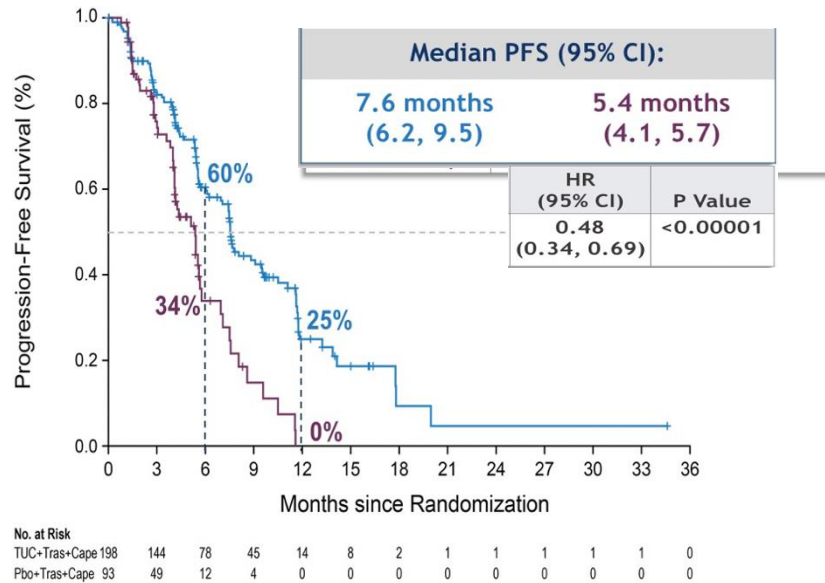
Curigliano G, Ann of Oncol 2022

# HER2CLIMB: Patients with Brain Metastases

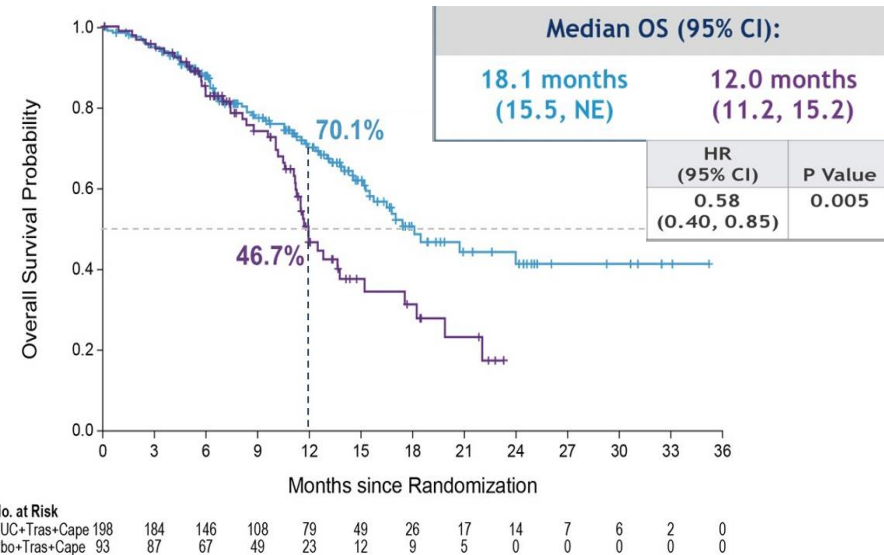
## Secondary analyses

**PFS**  
5.4 m vs 7.6 m  
P < 0.00001

**OS**  
12.0 m vs 18.1 m  
P = 0.005



Risk of progression in patients with BM was reduced by 52%



Risk of death in patients with BM was reduced by 42%

# HER2 CLIMB-02

## Key Eligibility Criteria

- HER2+ mBC
- Prior trastuzumab and taxane (pertuzumab permitted)
- Patients with or without brain mets

Randomized 1:1

N = 460

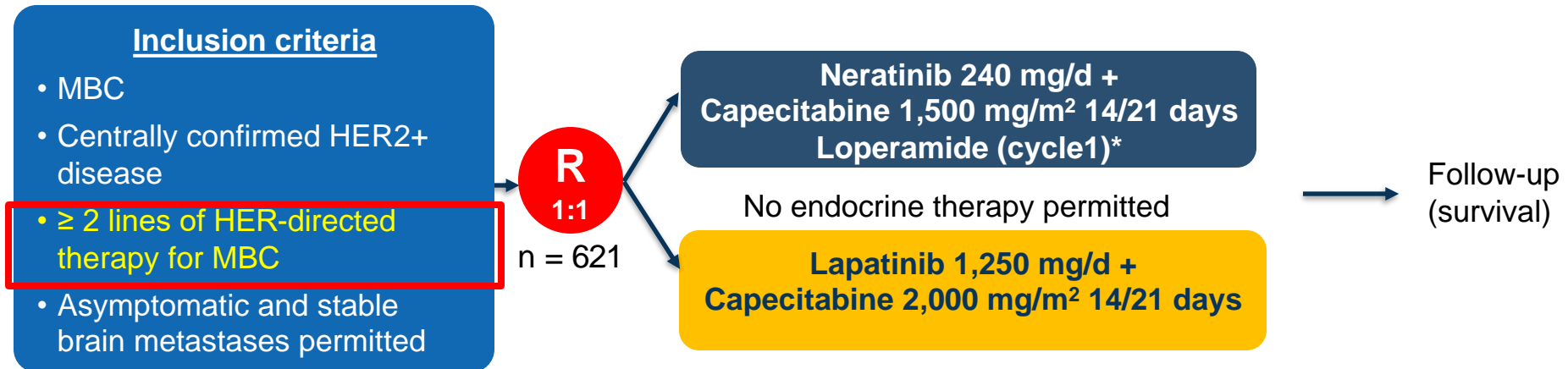
Tucatinib (300 mg orally BID) + T-DM1 (3.6 mg/kg IV Q3W)

Placebo (orally BID) + T-DM1 (3.6 mg/kg IV Q3W)

**Primary Endpoint: PFS**

- Prior Rx
  - 88-91% had prior HP
- PFS
  - ITT
    - 7.4 m vs 9.5 m (HR 0.76, p 0.0163)
  - Brain mets
    - 5.7 m vs 7.8 m (HR 0.64)
- OS
  - Not reached vs 38m (HR 1.23)

# NALA: Phase 3 Trial of Neratinib for HER2+ MBC



## **Endpoints**

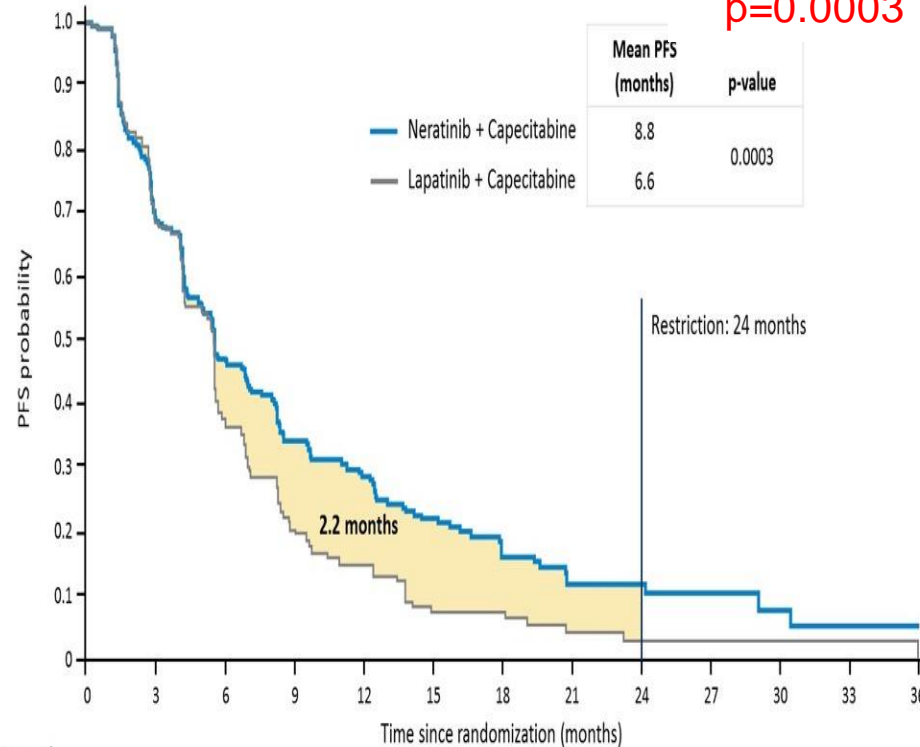
- **Co-primary: PFS (centrally confirmed) and OS**
- Secondary: PFS (local), ORR, DOR, CBR, intervention for CNS metastases, safety, health outcomes

\*Loperamide 4 mg with first dose of neratinib, followed by 2 mg every 4 hours for the first 3 days, then loperamide 2 mg every 6-8 hours until end of cycle 1; thereafter as needed; Saura C, et al. J Clin Oncol 2020 Sep 20;38(27):3138-3149.

# NALA: Co-primary endpoints of PFS and OS

Centrally confirmed PFS

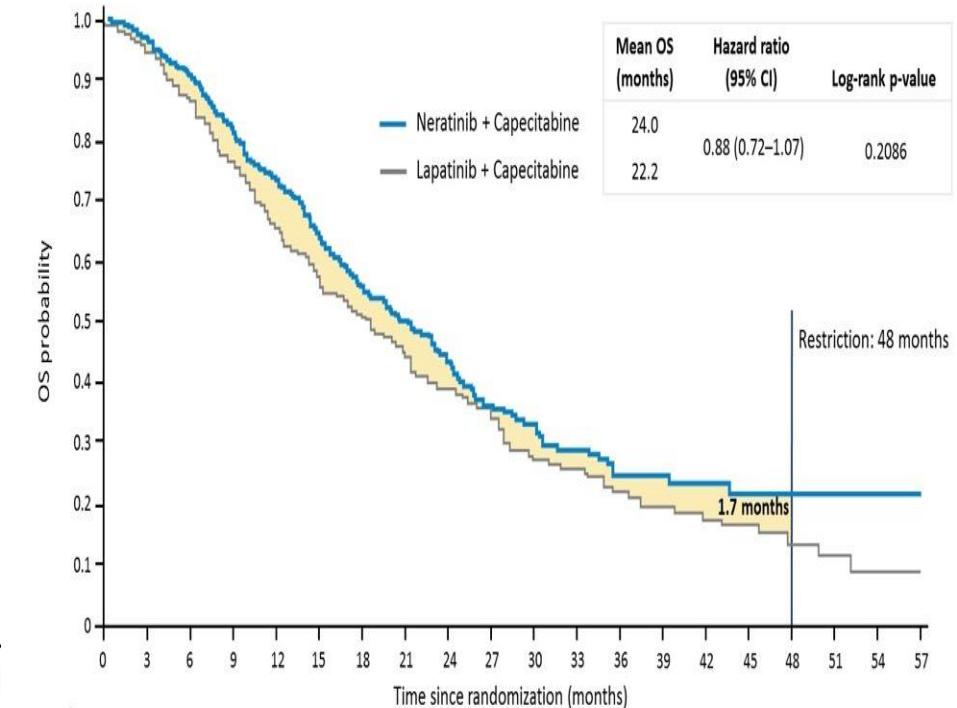
8.8 vs 6.6  
mo  
Δ 2.2 mo  
p=0.0003



No. at risk:	0	3	6	9	12	15	18	21	24	27	30	33	36
N+C	307	183	113	69	54	35	20	13	9	7	3	2	2
L+C	314	183	82	39	24	9	8	3	2	2	2	2	1

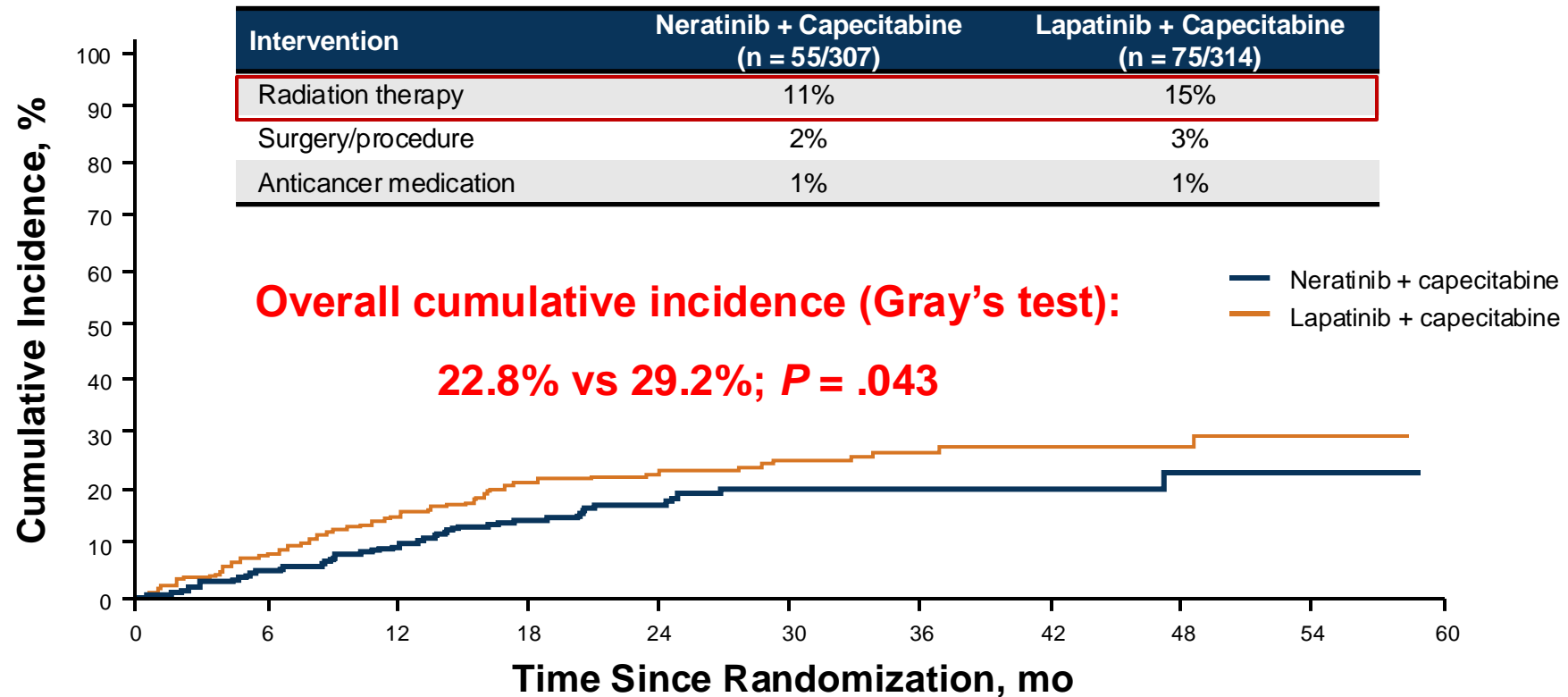
Overall Survival

24 vs 22.2mo  
Δ1.8 mo  
p=ns



No. at risk:	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57
N+C	307	294	275	244	220	182	142	112	82	64	47	34	28	18	15	13	6	4	2	1
L+C	314	303	273	240	208	170	132	107	84	67	47	36	27	22	17	12	8	4	3	1

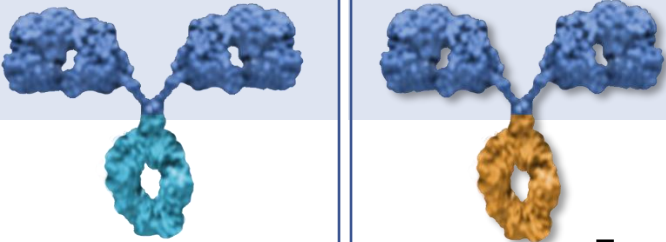
# NALA Trial: CNS Benefits in favor of Neratinib





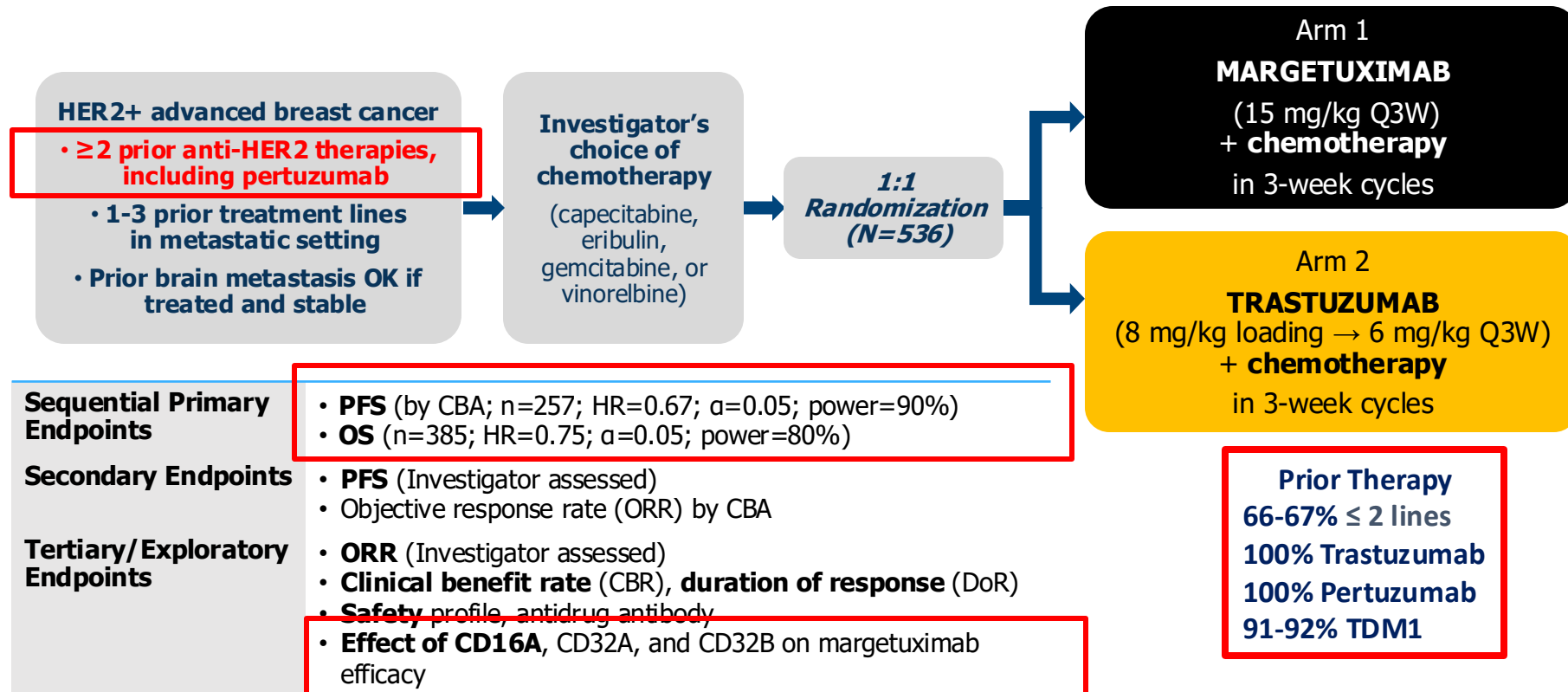
# Margetuximab: Fc engineering Alters Fc Receptor Affinities

Trastuzumab	Margetuximab <sup>1,2</sup>
<p><b>Fab:</b></p> <ul style="list-style-type: none"><li>• Binds HER2 with high specificity</li><li>• Disrupts signaling that drives cell proliferation and survival</li></ul>	<p><b>Fab:</b></p> <ul style="list-style-type: none"><li>• Same specificity and affinity</li><li>• Similarly disrupts signaling</li></ul>
<p><b>Fc:</b></p> <ul style="list-style-type: none"><li>• Wild-type immunoglobulin G1 (IgG1) immune effector domains</li><li>• Binds and activates immune cells</li></ul>	<p><b>Fc engineering:</b></p> <ul style="list-style-type: none"><li>• ↑ Affinity for activating Fc<sub>γ</sub> RIIA (<b>CD16A</b>)</li><li>• ↓ Affinity for inhibitory Fc<sub>γ</sub> RIIB (<b>CD32B</b>)</li></ul>



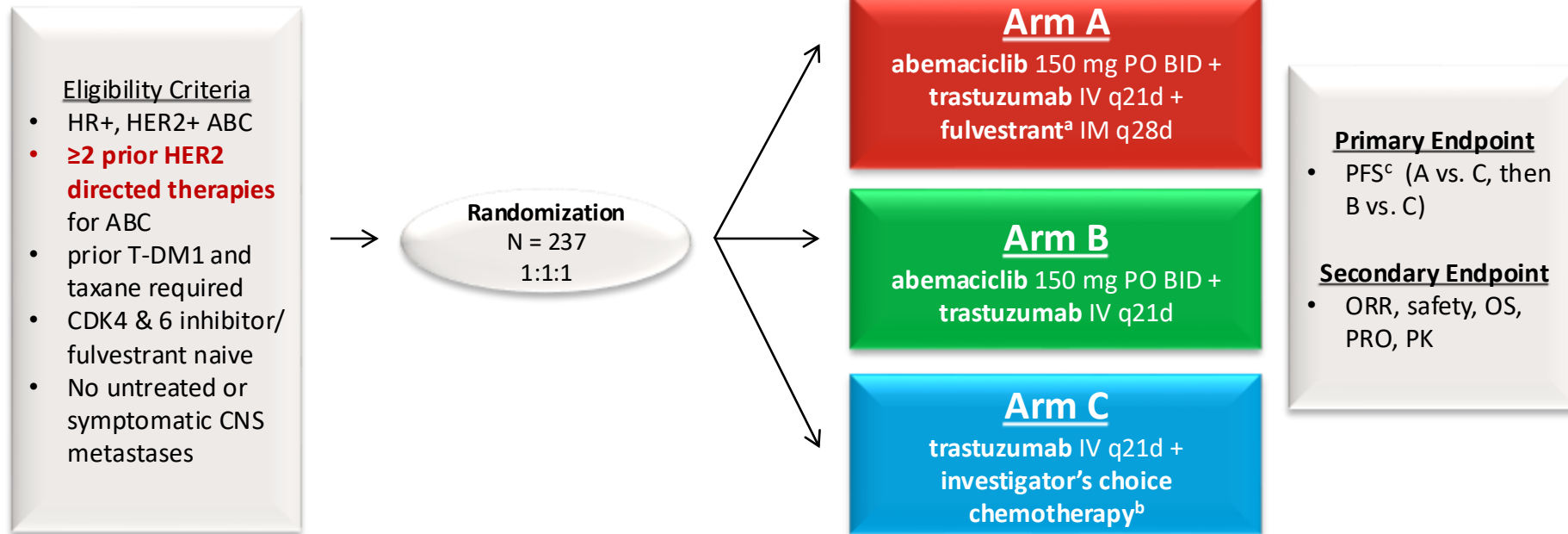
1. Nordstrom JL, et al. *Breast Cancer Res.* 2011;13(6):R123. 2. Stavenhagen JB, et al. *Cancer Res.* 2007;67(18):8882-8890.

# SOPHIA Study: Randomized Phase 3 Design



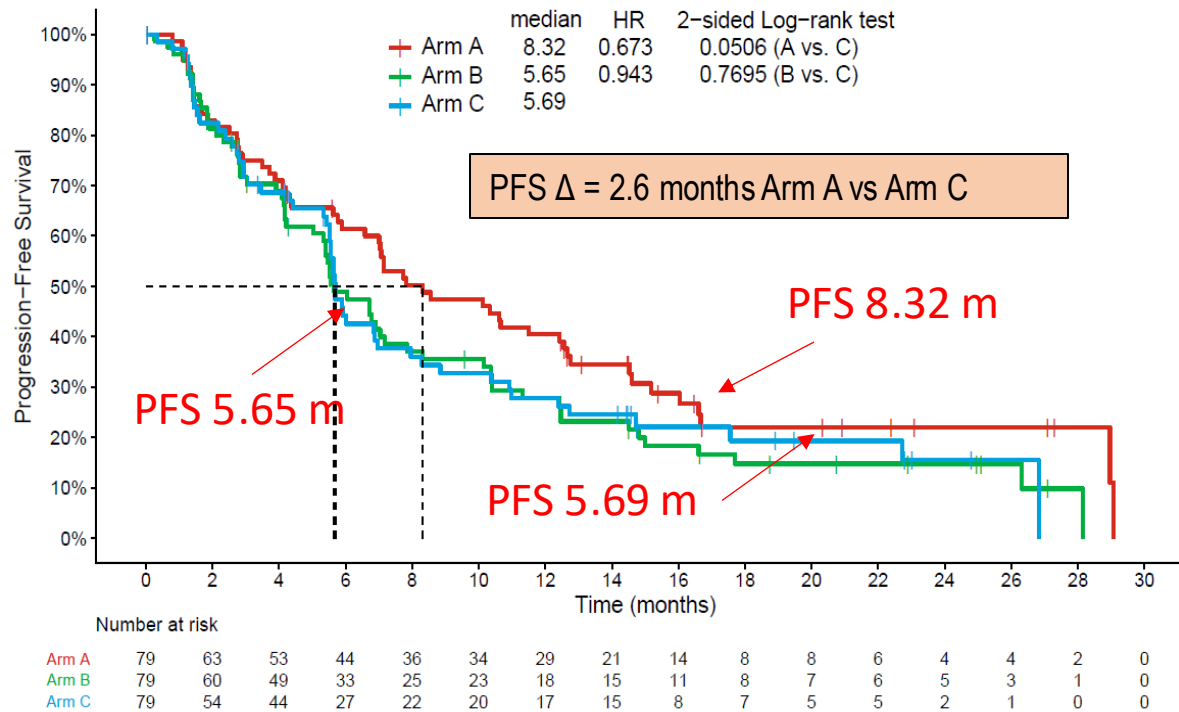
# CDK4/6 Inhibition in ER+ HER2+ MBC: monarcHER Trial

## Randomized Phase 2



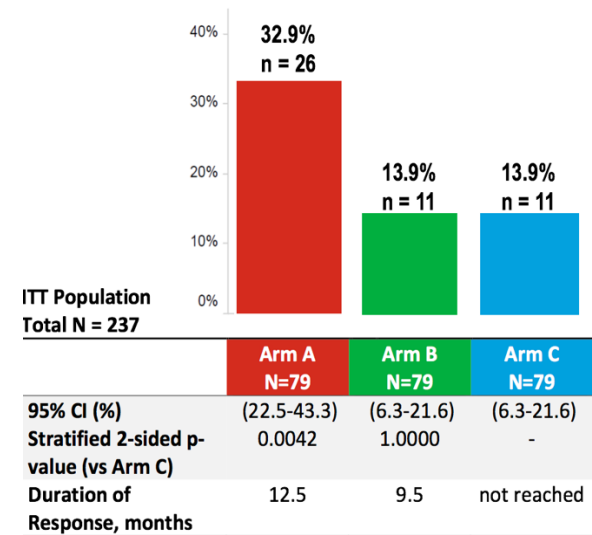
Tolaney et al, ESMO 2019:  
Tolaney et al, Lancet Oncol 2020

# MONARCHER Trial: PFS and ORR



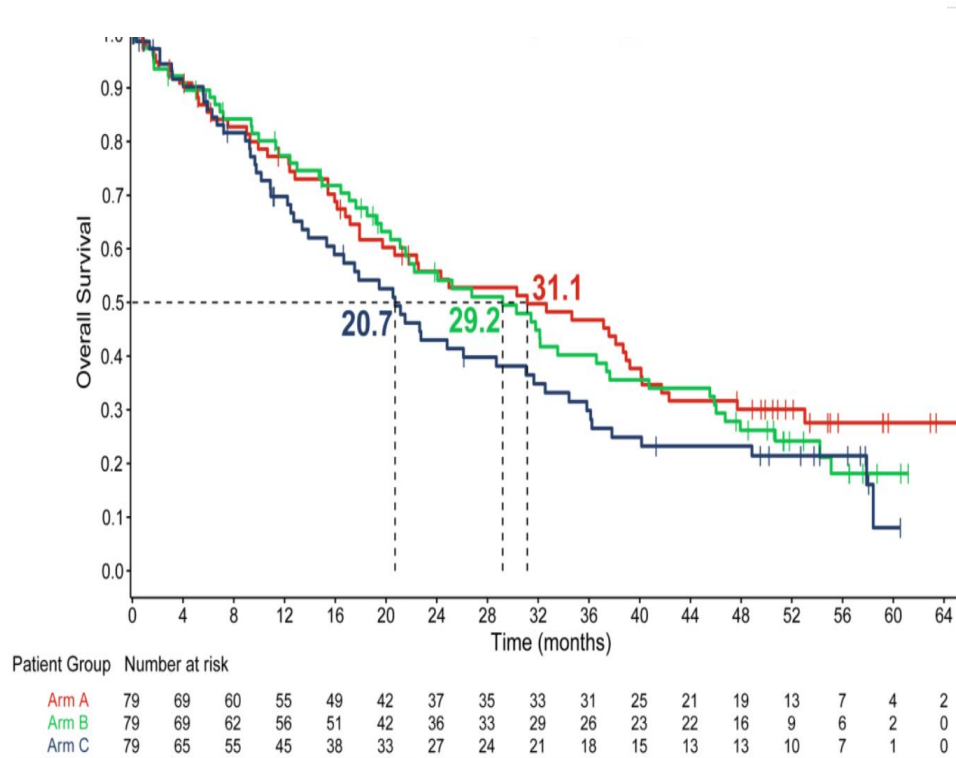
Arm A= abemaciclib + trastuzumab + fulvestrant; Arm B= abemaciclib + trastuzumab ; Arm C= trastuzumab + chemotherapy

## ORR in ITT Population



Tolaney et al, ESMO 2019:  
Tolaney et al, Lancet oncol 2020

# monarcHER Trial: Overall Survival



	Arm A	Arm B	Arm C
Events	50	54	53
mOS, (mo)	31.1	29.2	20.7
HR (95% CI)	0.71 (0.48, 1.05)	0.84 (0.57, 1.23)	N/A
2-sided P value	0.086 A vs. C	0.365 B vs. C	
Pre-planned Final OS Analysis Data cutoff: 31 Mar 2022			

Abemaciclib + trastuzumab +/- fulvestrant resulted in numerical improvement in median OS as compared to chemotherapy + trastuzumab.

# **Future Directions**

# Novel Treatments for HER2+ MBC In Development

## Antibodies/Bispecifics

- Zenocotuzumab
- Zanidatamab
- PRS-343
- BDC-1001
- Runimotamab
- MT-5111
- SBT6050
- SAR-443216
- NJH395
- KNO26

## Tyrosine Kinase Inhibitors

- Poziotinib
- Pyrotinib
- Epertinib
- BDTX-189
- DZD1516

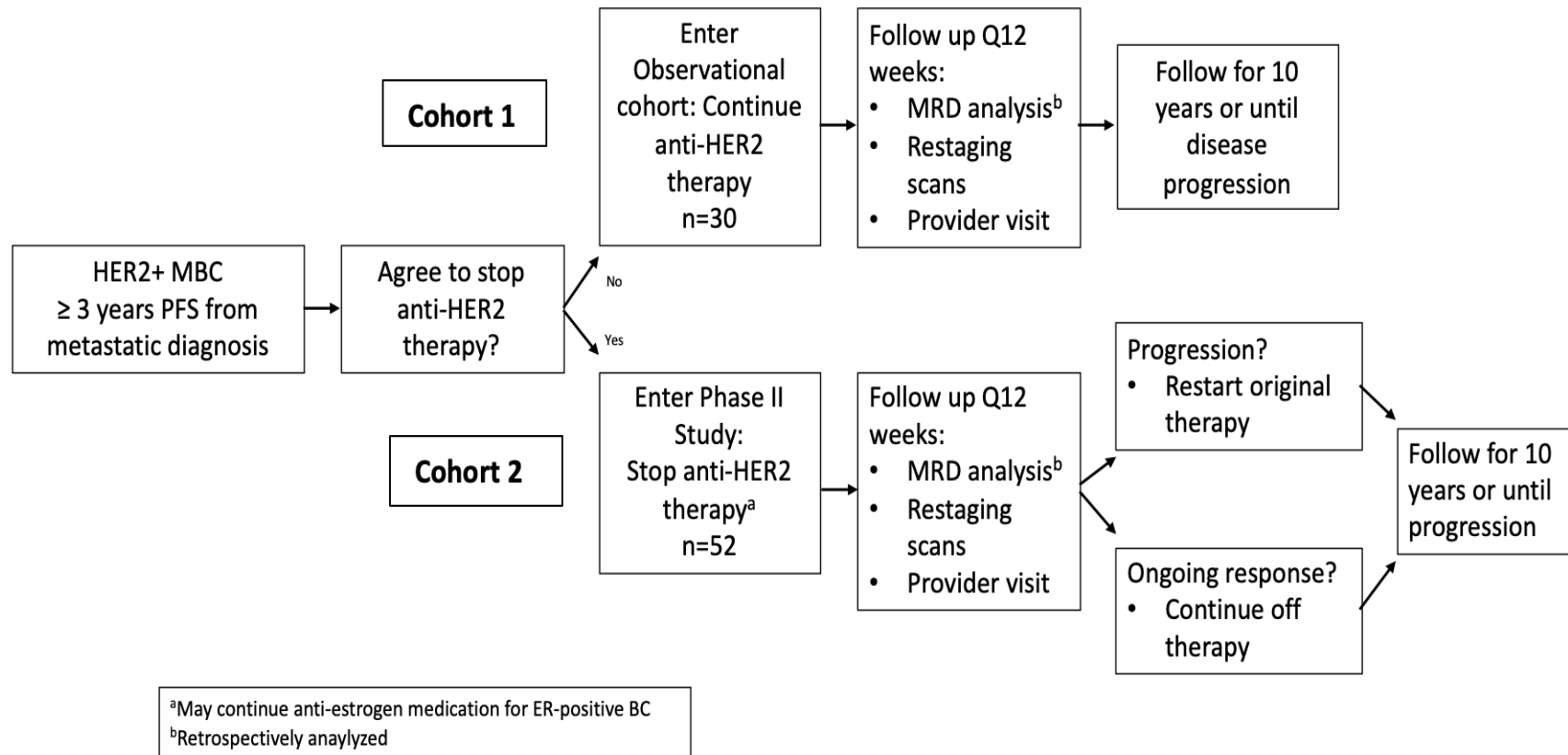
## ADCs & novel Conjugates

- ARX88
- Zanidatamab Zovodotin
- A166
- ALT-P7
- Disitamab vedotin
- XMT-1522
- ALT-P7
- DB-1303
- FS-1502
- DX 126-262

## Immune Therapies/Cellular Therapies

- Vaccines
- CAR-M; CAR-NK

# TBCRC Proposal: STOP-HER2 Trial Design



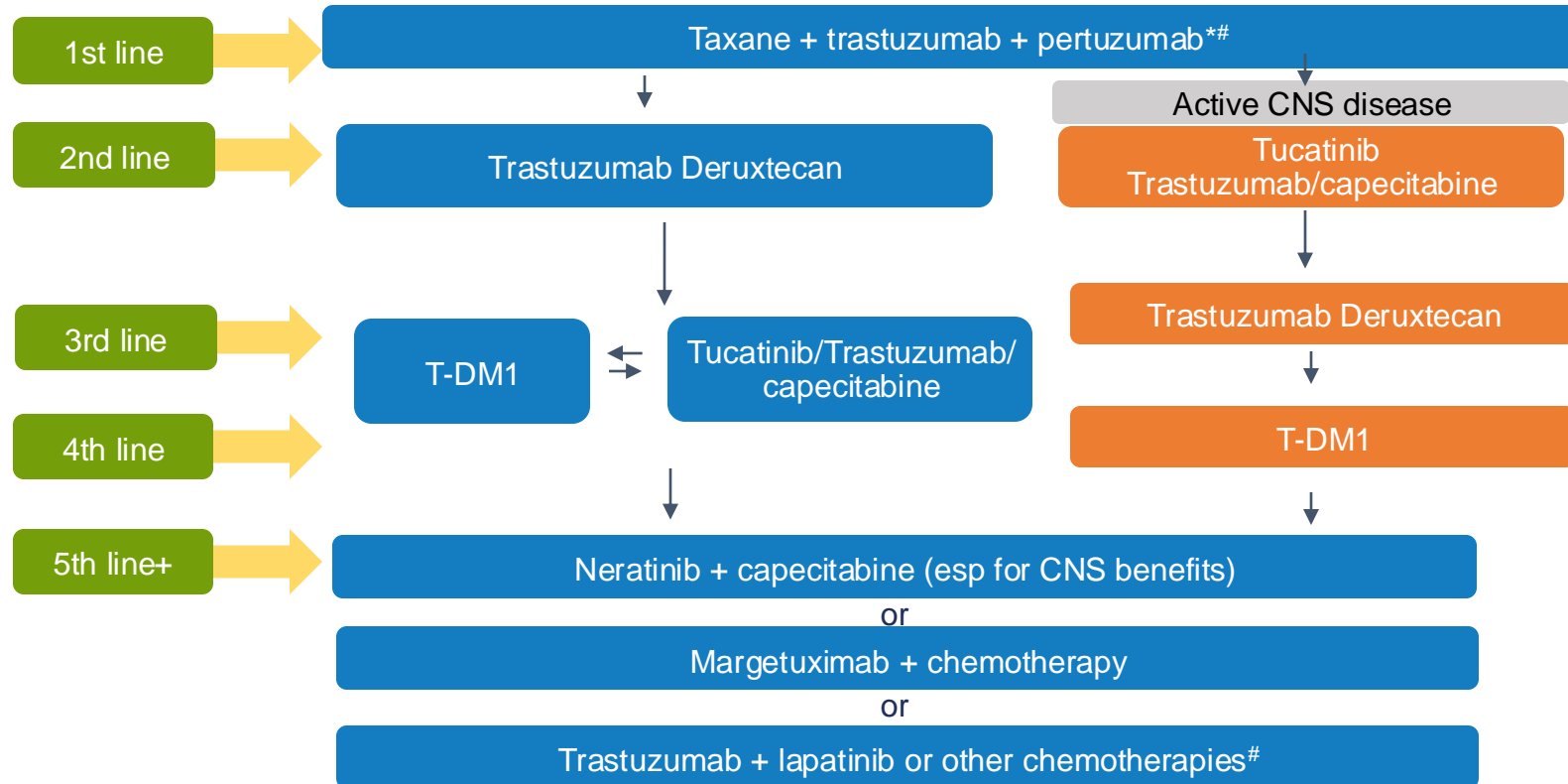
**Primary Endpoint: 1- year PFS in Cohort 2**



# Summary: HER2+ BC and Beyond

- Anti-HER2 Rxs-revolutionized outcomes for pts with HER2+ MBC
- Novel agents
  - ↑PFS ↑OS
  - Changed the natural history
  - Hold promise for CNS treatment for HER2+BC BM
- Personalizing HER2 Rxs requires understanding
  - Mechanisms of resistance
  - Optimal sequencing of Rxs

# A 2024 Approach to Therapy for Metastatic HER2+ BC:



\*AI+TP in select cases and for maintenance in ER+ disease; # endocrine Tx + HER2 therapy at clinically appropriate points for ER+ MBC



**Thank You!**